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PHILOSOPHICAL
Tranſactions:

GIVING SOME

ACCOMPT

OF THE

Preſent Uudertakings, Studies, and Labours

OF THE

INGENIOUS

IN MANY

CONSIDERABLE PARTS

OF THE

WORLD.

VOL. V.

For *Anno* 1670.

LONDON,

Printed for *John Martyn* at the Bell in St. *Pauls* Church-Yard; Printer to the *Royal Society*.

TO

THE TRULY NOBLE
PHILOSOPHER,
ROBERT BOYLE Eſq;
Brother to the Right Hononrable the
Earl of Burlington, &c.

SIR,

I *Cannot forbear any longer to addreſs one of the Volumes of theſe* Tranſactions *to You, to whom I moſt willingly profeſs I am ſincerely devoted, and who is known to have obliged the learned World with ſo many uncommon Diſcoveries in* Nature, *and ſo ſolidly maintain'd the Power and Uſefulneſs of Experimental Philoſophy. And this I do by offering you* this *Volume, becauſe in it (beſides other parcels of not ordinary remark elſewhere interſperſed) two of the Twelve Tracts are almoſt entirely your own; of which the judicious do generally affirm, that though they are draughts written only for your own memory, and have not yet the poliſhing of your laſt hand yet they contain moſt diving Reſearches into ſome of the deepeſt Receſſes of Nature, that ever appear'd in Publick; and have moſt induſtriouſly examin'd the Breath and Fuel of Life; the State of Air, and Water,* *in the various degrees of Rarity and Denſity, Weight, and Abſence, longer or ſhorter, for the* Reſpiration *of Animals; And have left us manifeſt evidences of the neceſſary Weight, and other enforcements of Air, to preſerve us from Suffocations and Convulſions; And that neither common Liquids can raiſe their Uſual Steams, nor the minuteſt Inſects continue their Motion even whilſt they retain life, without the Preſence and Help of Air.*

And yet I may be asked, what Patronage, what Heroe, or what Genius *can give ſafe-guard againſt the malicious ſcurrility of many of this Age, who attempt to deface every vertue, and whatſoever is excellent, and particularly that which is moſt obliging to the Publick? To this diſcouragement I reply cheerfully, that the malicious and ſcurrilous are ſhort-liv'd, and will ſoon expire in an odious ſnuff, or will haſten to hide themſelves in ſhame and confuſion: But* Truth *is mighty and will prevail;* Wiſedome *will be juſtifi'd;* Vertue *will in good time emerge;* Knowledge *will abound;* Arts *will flouriſh; and* Poſterity *will applaud them, from whom they receive the cleereſt Light and the beſt Accommodations.*

I am inform'd by ſuch as may well remember the beſt and worſt days of the Famous Lord Bacon; *That though he wrote his* Advancement of Learning, *and his* Inſtauratio Magna, *and many other elaborate Treatiſes of Philoſophy, in the time of his greateſt power; yet his greateſt Reputation rebounded firſt from the moſt Intelligent Forrainers in many parts of Chriſtendome: It cannot be doubted, but that* England *had then better knowledge of the abſtruſities, many troubles and burthens of our Municipal Laws, and Chancery, which lay long and much upon his ſhoulders; And that he bore the ſtreſs of State affairs in almoſt all King* James's *days, and in Queen* Elizabeth's *later days; That he adorned the ſolemn Addreſſes, and was the Extra-ordinary Pen-man for moſt Apologies, Deliberations, and graveſt Adviſo's in Parliaments, and otherwiſe: Here they ſaw alſo, How he excelled in the beſt Theology of that Age, and in the Politeſt of Civil and Moral Eſſays: And therefore here they might juſtly wonder, how a perſon ſo publickly immerſed in all Civil Intereſts ſhould find leiſure to do any thing at all in* Philoſophy: *And much more juſtly may we ſtill wonder, how, without any great skill in Chymiſtry, without much pretence to the Mathematicks or Mechanicks, without Optick Ayds, or other Engins of later Invention, he ſhould ſo much tran-*

ſcend the Philoſophers, then living, in judicious and clear inſtructions, in ſo many uſeful Obſervations and Diſcoveries; I think, I may ſay beyond the Records of many Ages. Hence, and from all this I would infer, that all Mortals muſt wait for their juſt renown poſt cineres, *after their mortality; and that Envy lyes cloſe at the doors, and purſues great merit to the laſt ſtages of life.*

Sir, As the Greek Poet fetch'd in Caſtor *and* Pollux *for his higheſt applauſes, when he had another concernment in his chief aim; ſo, that I may not by any Temptation put your Modeſty to a bluſh, I muſt continue to diſcourſe of the Lord* Bacon, Gilbert, **des**-Cartes, Gaſſendus, *and others the Miracles of modern and revived Philoſophy; of the indefatigable induſtry of ſome; the ingenious Contrivances of others; and of many their ſucceſsful performances. And truly 'tis to me very ſtrange, that ſeveral of theſe Excellent perſons have ſo luckily eſpouſed thoſe* Hypotheſes *of Nature in many true particulars, which* You *have by manifeſt Experiments evinced and confirm'd; as if by an eſpecial bleſſing upon their Labors, and for their good Affections towards Man-kind, they had been guided by an Heavenly Ray to divine, what would be the Reſult from diligent Tryals.*

And, ſince a noyſe hath been raiſed by temerarious Cenſurers againſt you, as if you were too indulgent to the old Atomiſts, *I hold my ſelf bound in Juſtice, to take publick notice of your impartiality, that you were neither led aſide on the one hand by the addiction to* Chymiſts, *to favour their Principles above truth; nor on the other hand, deterr'd by the Heatheniſh miſtakes about* Atoms; *nor by the Vulgar notions of the* Elements, *from giving due place to the* Corpuſcularians *(ſo far as they might have Truth on their ſides) even by the Aſſiſtance of* Chymiſtry; *as you have done moſt candidly in your* Sceptical Chymiſt, *and in your* Origine of Forms and Qualities.

And now Sir, this would look more like a neglectful Omiſſion of due Reſpects, than a juſt Addreſs, if I ſhould forbear to a knowledge, that you have ſo coherently deduced, and ſo conſpicuouſly illuſtrated the General, and the leſs Obvious Proceſſes of Nature in her Occult and ſubtile Influences, Whether Atmoſphærical, *or more remotely* Coſmical; *Whether* Celeſtial, Æthereal, *or* Aereal; *Whether* Subterraneous *or deſcending; Whether of Air, or any known kind of Water, Liquids, or Menſtruous; Spirituous,* *or in ſome degree Incraſſated; their Hydroſtatical tendency, Weight, or State; that it muſt give abundant ſatisfaction to future Ages, eaſe them of much pains, and allow them the more leiſure and manifold Aſſiſtances for further Proceſſes. I muſt add, that in the Treatiſes of* Firmneſs *and* Fluidity *of* Cold, *and the* Thermoſcopical *Meaſures of Warmth and Frigidity, of* Colours *and* Light, *you have given us good ground for our Reſt, and for a fair proſpect into the Labyrinths of* Nature. *Beſides, I muſt take the freedom to ask, Who did ever ſuſpect the Ambient Air of having ſuch a force to conſolidate firmneſs in ſtubborn and unflexible Bodies, as you have ſhew'd it to have? Who ſuſpected, that Air (the pureſt we can obtain ſo near the ſurface of the Earth) ſhould ſo widely* Expand *it ſelf when at ſome liberty; or ſhould endure ſuch Mechanical* Compreſſions? *That the moſt* Solid *Bodies we have amongſt us ſhould emit ſpacious Atmoſpheres; and that the parts of our firmeſt Rocks and Jewels are not in an* abſolute *Reſt in their long laſting duration? What divining Imagination or Conjecture did admit of all theſe points for ſound Philoſophy, till you taught us to feel it in our Scales, and to ſee it with our Eyes?*

But I muſt not here heap up together your many coſtly and aſſiduous Labours: I muſt ſtop my Pen, and conſider more what your Ears can bear, than what is due to your Merit. Only this I muſt here avouch, as one amongſt a great number of good Witneſſes, that many of the moſt learned Forrainers (to ſay nothing now of worthy Engliſhmen) do ſo highly value all the Treatiſes you have publiſhed, that they do importunately deſire, your Desks were forthwith emptied into the publick Light, and carefully rendred into their known Languages.

Sir, all that value true Worth and true Philoſophie, are bound to pray for the Recoverie of your Health and Strength, and for your long Life, and perpetual Increaſe in all Happineſs. So does he, who eſteems the moſt uſeful things in Human Societie, to be Knowledge *and* Vertue, *(combined in you,) and who is*

SIR,
Your very Humble and Faithful Servant,
HENR. OLDENBURG Soc. Reg. Secr.

Trans. N° 57.

Fig. II.

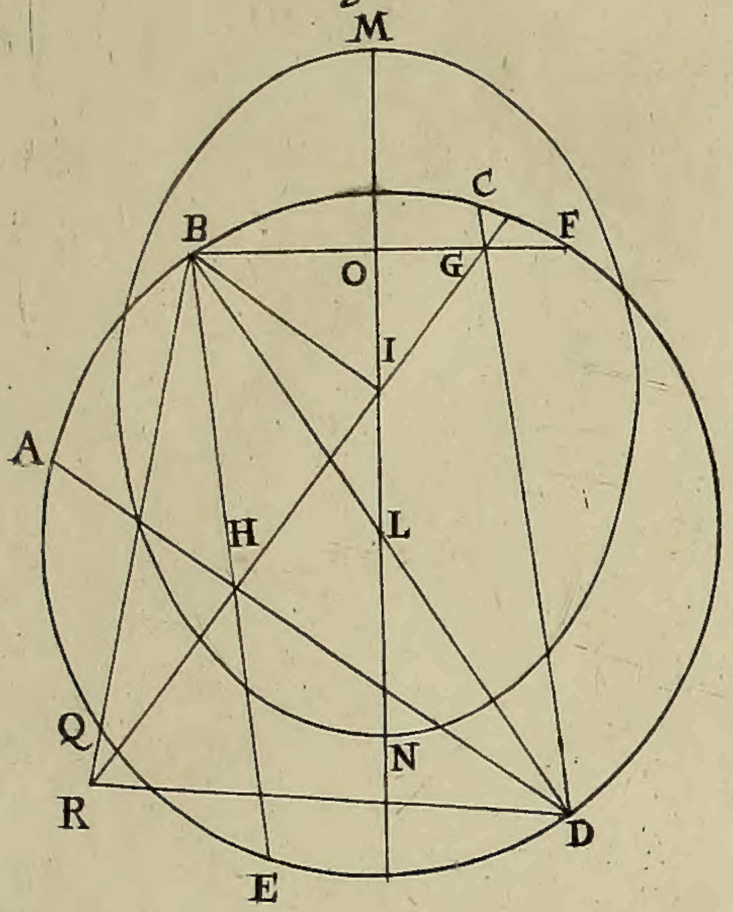


Fig. III.

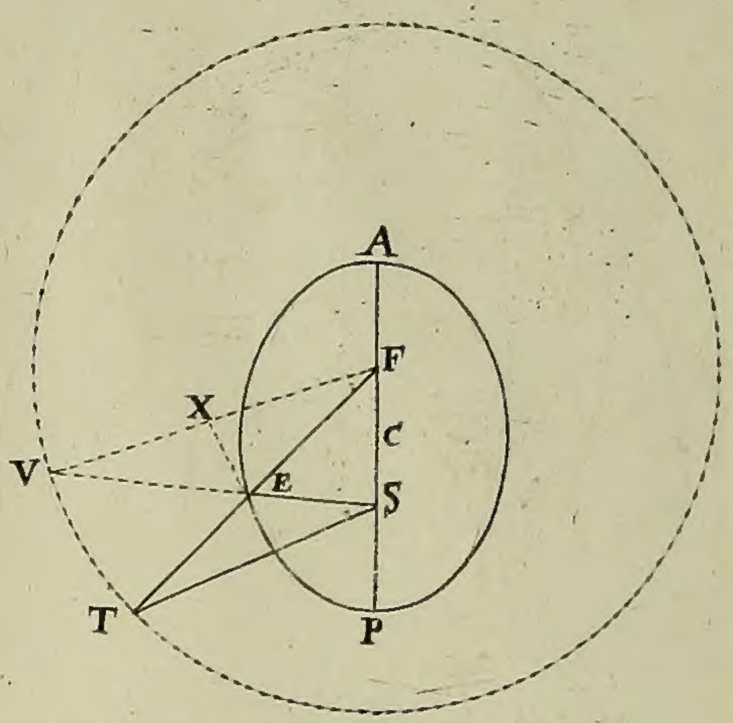


Fig. I.

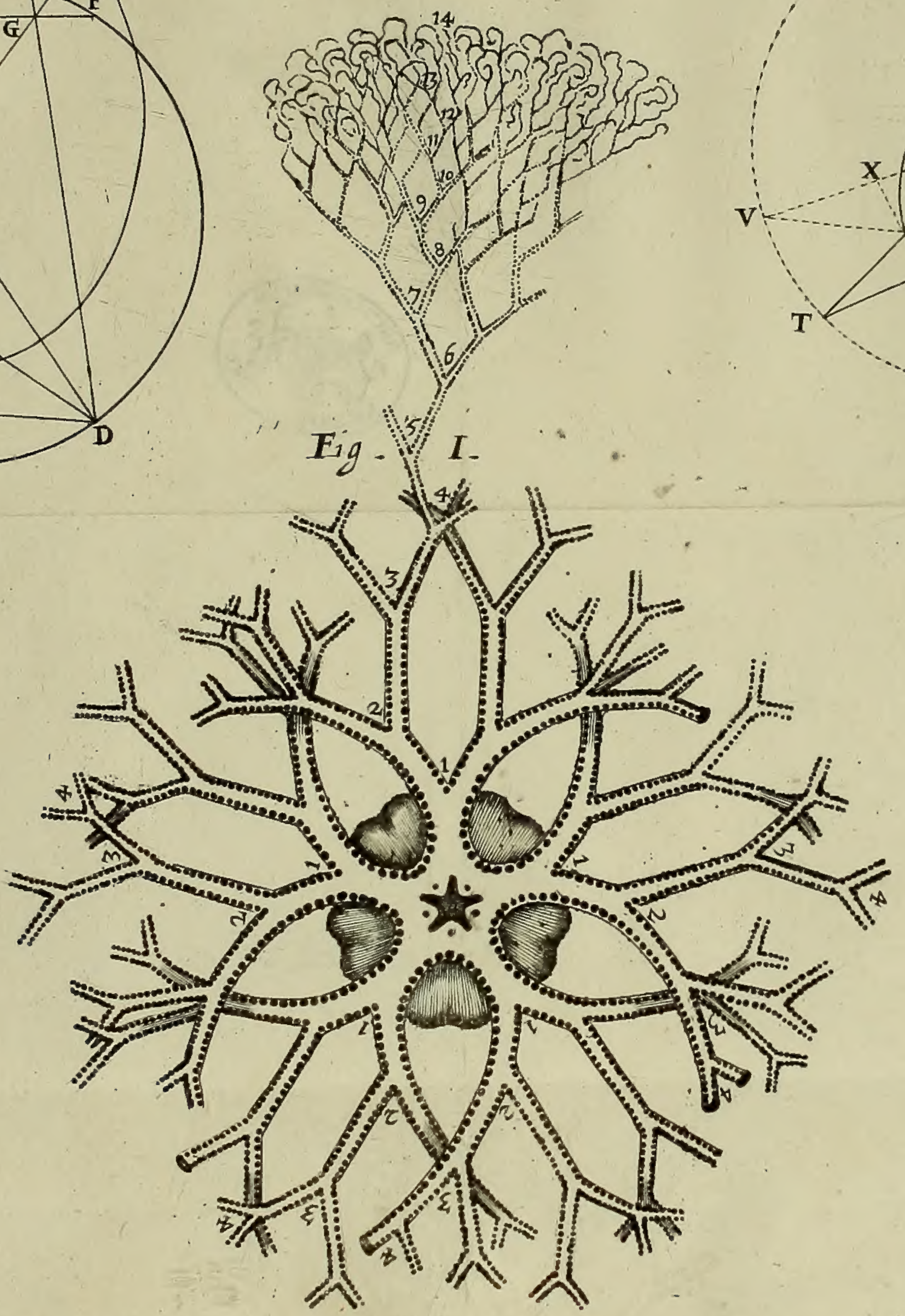


Fig. IV.

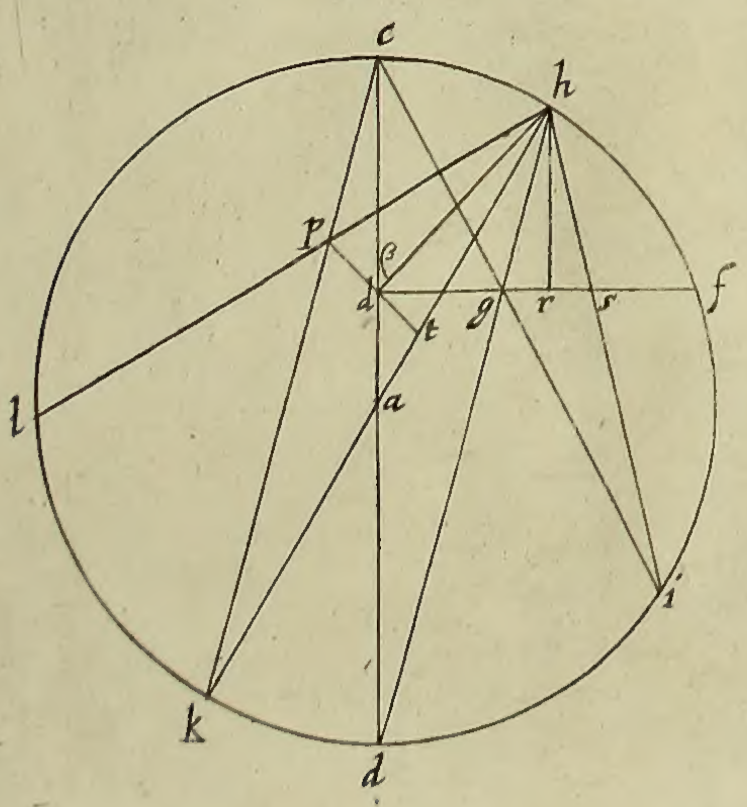
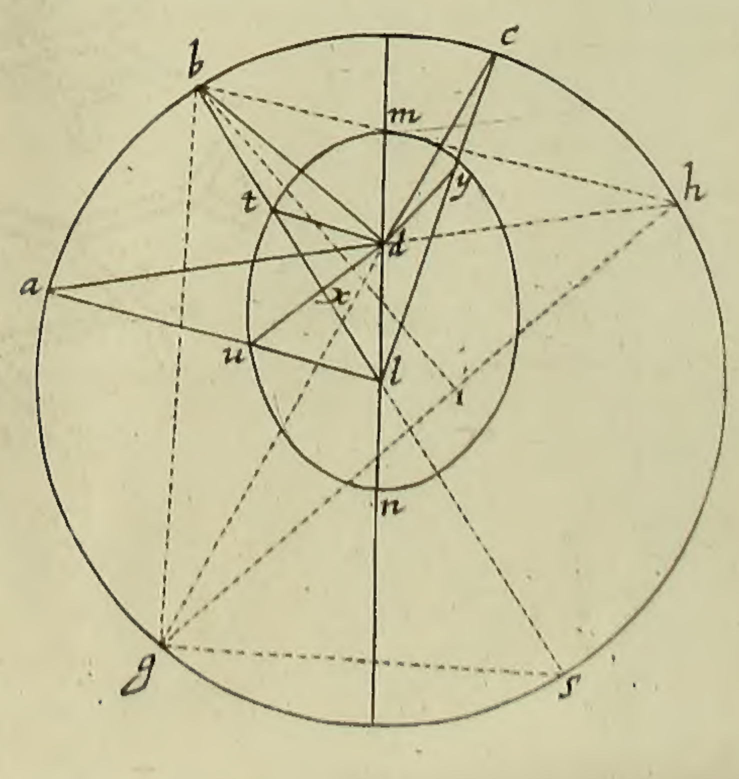


Fig. V.



Numb. 57.

Beginning the Sixth Year.

PHILOSOPHICAL TRANSACTIONS.

March 25. 1670.

The Contents.

A Preface to the Sixth *Year of theſe Tracts. Some Communication from* New England. *The Ingenious Reflexions relating to* Medical Springs *Numb.* 52, *Conſidered. The palpable Indications of ſome* Healing *Springs remarked: with an Accompt of ſome ſuch Springs in* England, *which confirm the Indications, and of others* obiter. *A Proſecution of the formerly begun Inquiries, Directions and Experiments, concerning the* Motion *of* Sap *in Trees. Some Conſiderations touching the Geometrical Method of Signor* Caſſini *for finding the Apogees, Excentricities and Anomalies of the Planets. An Accompt of 3. Books,* I. *Experienze intorno alla GENERATIONE DEGL' INSETTI, fatte da* Franc-Redi, *Academico della* Cruſca. II. PHARMACOPOEIA *REGIA, ſive Diſpenſatorium novum locupletatum & abſolutum, cum annexa* Mantiſſa Spagyrica, *&c.* III. *AFFECTIONUM quæ dicuntur HYSTERICÆ* & *HYPOCHONDRIACÆ Pathologia Spaſmodica Vindicata: nec non Exercitationes duæ,* 1. *De SANGUINIS ACCENSIONE.* 2. *De MOTU MUSCULARI, Auth* Tho. Willis, *M. D. &c.*

A Preface
To the *Sixth* Year of theſe Tracts.

IN *this Month of* March *we enter into the* Sixth *Year of our Philoſophical Communications; which if in any meaſure they have been acceptable to the Ingenious, we have our aim, and the ſatisfaction we ſidere.*

Before I enter upon new matter, I ſhall beg the Readers leave to caſt an Eye back, as formerly, and review what we have endeavour'd to do hitherto, that I may remark the concernments, why, and upon what occaſion I adopted the Arguments all along; and that I may thence take freſh encouragement, and clearer inſtruction for our future Collections.

In the laſt Preface *before our* fourth *Volum, I gave a* Synopſis *of the main importance of our* three *foregoing Books, inſerting a particular recommendation of the extenſive Uſefulneſs of ſome Artificial Inſtruments lately invented. To the Catalogue of Inſtruments there recited, or hinted, we have ſince added (in the 4th* Vol.) *ſome Inventions or Applications, which either have not been formerly thought of, or have been long ſought and in vain attempted, or have made diſcovery's contrary to old Expectations, and even ſometimes to the confident Aſſertions of Acute and very Inquiſitive men. What* Peripatetick *would endure to hear of weighing water in water?* There *we have a Demonſtration, How to eſtimate the particular weight of any quantity of Liquors in Liquors, exactly, and by ordinary Balances and Weights. And this is performed by the ſame happy hand, which before directed us, How to find and denominate the particular Weight of any parcel of Air in Air, or of any Pillar of Air of the whole Atmo-ſphere, of any ſize, in any place where we can come, whether clear'd, or laden with exhalations, clouds, ſnow, hail, or other Meteors, how high ſoever they aſcend; and the ſame ſlight Engin (the Ballance) hath in the ſame hand detected an Atmoſphere in the moſt Solid Bodies.*

'Tis a long time ſince the Mechanical Witts have conſulted, How to improve Optical Glaſſes *by the* Hyperbolical *Section:* There *we have the Propoſition demonſtrated, and the Engin directed for practice. The skill of drawing in* Perſpective *is as a pleaſant Companion to the Travaylor, and enables him to give a lively Hiſtory of his Travels for the information of others:* There *we may find, how to draw in Perſpective any Objects both accurately and diſpatchingly, by an Inſtrument; as any vulgar hand may draw a Circle more perfectly by a Compaſs, than the moſt perfect Penman can do by his hand alone: And we have gotten a little ſtep on towards the advancing of Metalline Burning Concaves, of which the performance is there particulariſed.*

We ſhall not inſiſt on the Advancements, we have there given notice of, in Anatome, in Mathematicks, and particularly in diſcovering the Lawes of Motion; in the Labyrinths of Algebra; the Reſolution of Æquations in Numbers; Guaging; Directions how to find the Longitudes by the Pendul; Aſtronomicals &c.

We have been allarm'd by the extraordinary Eruptions of Mount Ætna, *to inquire more diligently into the Cauſes and Effects of thoſe Subterraneous Fires; the Prognoſticks and Concomitants of thoſe Eruptions; what Minerals they have indicated or ejected: Of which we yet expect much better ſatisfaction from an eminent Philoſopher, who lives near the place to obſerve all circumſtances. Alſo the Drought of this Summer, and of a good part of this Winter, hath minded us to inquire further into the cauſes, varieties and properties of Springs; of Subterranean Steams and Liquors. There we have alſo the Art uſed* to make Salt *of Sea-water by the Sun, and of Salt ſprings by Coppers, Boylers and Furnaces. Our Engliſh Hot-ſprings at* Bath *after ſecond disquiſitions reported. Our Baroſcopes have ſhew'd the Air to be more ponderous, even when it was cleareſt, ſometimes in a bright and warming Sun-ſhine, and ſoon after the Winter-ſolſtice, than ever, I think, we found it, ſince we were inſtructed to apply the Inſtrument for ſuch diſcoveries. And the ſame we might affirm of the Froſts following about a fortnight after the Solſtice* (that they were more extreme, than in very cold winters before,) *if we had not had ſome doubt, that the liquor in the Thermometer might in time ſuffer ſome change, or diminution, which might elude the true and punctual indication, when we compare one year with an other for many years together.*

Some Learn'd men have taken much pains, diſputed, written and read much, to find out the Head of the Nile, *and the Cauſe of that Rivers Inundation.* There *we have the true diſcovery, addreſſed to the* R. Society.

We have alſo mentioned the way of teaching Latin, *as of old it was learnt, and as other Languages are taught by* Uſe *alone. We have given notice of a Foundation laid to teach the Deaf and Dumb to ſpeak. We have ſhew'd by brief touches from the wealthy* Japan, *How much knowledg and Philoſophy may be contain'd in a faithfull Hiſtory of Places. And an Eaſt-Indian Voyage, as there de-*

ſcribed, may both prepare and inform thoſe that are embarked in that adventure, and alſo give the Light of various Arguments to our domeſticks.

Chronology affords us the beſt view of all Times paſt; but, after all Emendations, is ſtil involv'd in much obſcurity: There *are freſh Eſſayes to extricate the difficulties; and ſeveral hands at work, to remark the Products of all former Ages.*

Medical Obſervations of peculiar curioſity, and the Singularities of Humane Bodies are not pretermitted. The Reſtleſneſs of particles in Solid Bodies repreſented, and modeſtly argued. Botanicks happily entertained, and reduced to a Natural Method. The Sylvan, Hortulan and Olitory affairs, for Forreſts, Groves, Orchards, Nurſeries, and fruitful Gardens revived with great vigor, and with manifold ſupplies. Vegetables brought under a Philoſophical conſideration: The Motion and the uſes of Sap in Trees diſcuſſed: The nearer affinity of their ſeveral parts inquired, to the intention of altering, mixing and multiplying divers kinds very many ways. The Musk-melon how to be cultivated to great perfection, &c.

Thus we have briefly touched, what parts of uſeful Philoſophy are now advancing; and theſe being the labours and ſtudies of others, I preſume, I may, without offence to any good men, claim the freedom to give them due applauſe. And now, let Envy ſnarle, it cannot ſtop the Wheels of Active Philoſophy, in no part of the known world. Not in France, either in Paris *or at* Caen. *Not in* Italy, *either in* Rome, Naples, Milan, Florence, Venice. Bononia, *or* Padua. *In none of the Univerſities, either on this or that ſide of the Seas.* Madrid *and* Lisbon, *all the beſt Spirits in* Spain *and* Portugal, *and the ſpatious and remote dominions to them belonging; the Imperial Court, and the Princes of* Germany; *the Northern Kings, and their beſt Luminaries; and even the frozen* Muſcovite *and* Ruſſian, *have all taken the Operative ferment; and it works high, and prevails every way, to the encouragement of all ſincere Lovers of Knowledg and Vertue.*

An Extract of a Letter,

Written by John Winthrop Eſq; *Governour of* Connecticut *in* New England, *to the Publiſher, concerning ſome Natural Curioſities of thoſe parts, eſpecially a very ſtrange and very curiouſly contrived Fiſh, ſent for the Repoſitory of the* R. Society.

I Know not, whether I may recommend ſome of the productions of this Wilderneſs as rarities or novelties, but they are ſuch as the place affords. There are, amongſt the reſt, 2. or 3. ſmal Oaks, which though ſo ſlender and low (as you may ſee, if they come ſafe) have yet Acorns and cups upon them, ſo that it may be truly ſaid, that there is a Country, where Hoggs are ſo tall, that they eat acorns upon the ſtanding growing Oakes. This is every year viſible in many parts here, there being of this ſort of dwarf-Oak whole Forreſts in the Inland Country; too many for the Husband-man, who finds that ſort of land moſt difficult to break up at firſt with his plough, in regard that the whole ſurface is fill'd with ſpreading ſtrong roots of this ſort of Oak. Neither muſt it be thought, that they are ſmall ſhoots, which in time would grow big trees; for, where theſe grow, there are no great Oaks, or very few amongſt them. But whether it be a novelty to ſee ſuch kind of dwarf-trees bearing acorns, I know not: It was to me, having not ſeen the like (as far as I remember,) in *England* or *France*, or other parts. Mean time I have obſerved, that in ſome Plains, full of theſe ſhrubs, there have been no acorns on moſt of them; but whether in other years they were not fruitful, I know not. Some years, we know, even the great Oaks bear no fruit, which are very full at other times; but this year throughout the whole Country there is plenty of acorns; and I ſhould be glad to be informed, whether this year they have been alſo abounding in *England*, or other parts of Europe; and if ſo, or not ſo, poſſibly ſomething not altogether inconſiderable may be thence inferr'd. Beſides, if ſuch dwarfiſh Oakes, as theſe, ſhould be found in other parts of the World, it were not amiſs, me thinks, to inquire, Whether it be not ſome Mineral ground, where theſe grow; and if ſo, what ſorts of Minerals thoſe places afford?

There are alſo ſent you ſome pieces of the Bark of a Tree, which grows in *Nova-Scotia*, and (as I hear) in the more Eaſterly parts of N. *England*. Upon this bark there are little knobs, within which there is a liquid matter like Turpentine (which will run out, the knob being cut open) of a very ſanative nature, as I am informed by thoſe, who affirm, that they have often tryed it.

In the ſame Box are Pods of a Vegetable, we call *Silk-graſs*, which are full of a kind of moſt fine down-like Cotton-wool, many ſuch flocks in one and the ſame pod ending in a flat Seed. 'Tis uſed to ſtuff up Pillows and Cuſhions; being tryed to ſpin, it proves not ſtrong enough. The Seeds 'tis like may grow with you, if ſet in ſome Garden; whereby the whole Plant may be ſeen.

You'l find alſo a Branch of the Tree, call'd the Cotton-tree, bearing a kind of Down which alſo is not fit to ſpin. The Trees grow high and big. At the bottom of ſome of the Leaves, next to the ſtalk of them, is a knob, which is hollow, and a certain fly, ſome-what like a pis-mire-fly, is bred therein.

More-over, there are ſome of the *Matrices*, in which thoſe Shels are bred, of which the *Indians* make the white *Wampanpeage*, one ſort of their mony: They grow on the bottom of Sea-bays, and the ſhels are like Periwinkles, but greater. Whilſt they are very ſmal, and firſt growing, many of them are within one of the concave receptacles of theſe *Matrices*, which re very tough, and ſtrong, ſo contrived, that they are ſeparate from one another, yet ſo, that each of them is faſtned to a kind of skin, ſubtended all along to all theſe caſes or baggs.

There is, beſides, in a large round Box, a ſtrange kind of *Fiſh*, which was taken by a Fiſherman, when he was fiſhing for Codfiſh in that Sea, which is without *Maſſachuſet* Bay in N. *England*. It was living, when it was taken, which was done, I think, by an hook. The name of it I know not, nor can I write more particularly of it, becauſe I could not yet ſpeak with the Fiſherman, who brough it from Sea. I have not ſeen the like. The Mouth is in the middle; and they ſay, that all the Arms, you ſee round about, were in motion, when it was firſt taken.

We omit the other particulars here, that we may reflect a little upon this elaborate piece of Nature, the Fiſh, *which,* See Fig. I.

ſince it is yet nameleſs, we may call Piſcis Echino-ſtellaris Viſciformis; *its Body (as was noted by M.* Hook) *reſembling an* Echinus *or* Egg-fiſh, *the main Branches, a* Star, *and the dividing of the branches, the Plant* Miſſel-toe. *This Fiſh ſpreads itſelf from a* Pentagonal *Root, which incompaſſeth the Mouth (being in the middle at* a) *into 5 main Limbs or branches, each of which, Juſt at the iſſuing out from the Body ſub-divides it ſelf into two (as at 1.) and each of theſe 10 branches do again (at 2.) divide into two parts, making 20. leſſer branches: Each of which again, (at 3.) divide into 2. ſmaller branches, making in all 40. Theſe again (at 4.) into 80; and thoſe (at 5.) into 160; and they (at 6.) into 320: they (at 7.) into 640; at 8, into 1280; at 9, into 2560; at 10, into 5120; at 11, into 10240; at 12, into 20480; at 13, into 40960; at 14, into 81920: beyond which, the farther expanding of the Fiſh could not be certainly trac'd, though poſsibly each of thoſe 81920 ſmal ſprouts or threds, in which the branches of this Fiſh ſeem'd to terminate, might, if it could have been examined when living, have been found to ſubdivide yet farther. The Branches between the Joynts were not equally of a length, though for the moſt part pretty near: But thoſe branches, which were on that ſide of the Joynt, on which the preceding Joynt was placed, were always about a* 4th *or* 5th *part longer than thoſe on the other ſide. Every of theſe branchings ſeemed to have, from the very mouth to the ſmalleſt twiggs or threds, in which it ended, a double chain or rank of pores, as appears by the* Figure. *The Body of the Fiſh was on the other ſide; and ſeemed to have been protuberant, much like an* Echinus (Egg-Fiſh *or* Button-Fiſh) *and, like that, divided into 5. ribbs or ridges, and each of theſe ſeemed to be kept out by two ſmall bony ribbs.*

In the Figure *is repreſented fully and at length but one of the main branches, whence 'tis eaſy to imagine the reſt, cut off at the* 4th *ſub-dividing Branch, which was done to avoyd Confuſion as well as too much labour and expence of time in the Engraving.*

The Figure, well viewed and conſidered, will be more inſtructive, than a larger Diſcourſe thereon; though other particularities might have been mention'd, if the dryneſs, perplexedneſs and brittleneſs of the Fiſh had not hindred it.

The

The Ingenious Reflexions relating to Medical Springs *Numb.* 52, *Conſidered. The palpable Indications of ſome* Healing *Springs remarked; With an account of ſome ſuch Springs in* England, *which do confirm the Indications; and of others* Obiter; *By Dr.* J. Beale *to the Publiſher: Which Diſcourſes were in* N. 56. *omitted for want of ſufficient room, not without injury to the Author, who had deſigned theſe Communications for another prop, ſpecifying by manifeſt obſervations, how Terreſtrial ſteames may be the Generative Cauſe, both of Minerals and Metals, and of all the Peculiarities of Springs: And ſhould have immediately followed* p. 1134.

IN *purſuance of what I offered* (Numb. 56.) *concerning* Mineral *Springs, I proceed to the Ingenious Reflexions made* Numb. 52 *on the Breviate of Dr.* Witties *Defence, which is in your* Tract 51; *With no* Intention *at all to affront the worthy Authors modeſt Suggeſtions; but to repreſent matter of Fact, and manifeſt Obſervations, which may chance to ſatisfy ſome of his Inquiries; And to give more Light to my forementioned Arguments.*

We agree that ſome *Medical* Springs do looſe part of their Vertue by the precipitation of a Mineral Sediment. But, whether theſe Waters do not looſe ſome of their Vertue (and perhaps the more excellently *healing* property) by a ſeparation of finer and Inviſible Spirits from the water, either by avolation out of the ſealed Veſſels, or otherwiſe; This is now a part of my preſent Queſtion. And I would here have a regard to other *Healing* Springs, than are apparently Mineral. And thus far I would advance my former inquiry; Whether the various Compreſſions, Strainings, and Colliſions, together with the changes of Heat and Cold, with other unknown Steames, may not ſo far alter the Contexture, and the minuteſt Particles of ſome waters, as to render *them effectually Sanative, whilſt they retain the force of their efferveſcence; and ſoon after to leave them impotent.*

We ſee, what a ſmoaky vapour aſcends from the pureſt Fountaines in Winter, and in the cool Mornings of the Hot Summer: And, though we dare not call theſe Waters hot, or more than relatively tepid, yet the Water being leſs cold whilſt it is ſalient, ſo long it may be enlarged in Bulk, and hold no longer in the ſame Quantity. And Heat and Cold, and, if there be any other Ætherial Concomitants, (tho but as tenuious as Magnetiſmes,) may paſs through Sealed Veſſels: Some perhaps more eaſily through ſome kinds of Veſſels than through others; as Light, and the thinneſt Flames of Fire: Though Air be commonly the Fuel and Bellowes, and ſometimes the Vehicle, yet they paſs through Glaſs, where *Air* cannot paſs; But they paſs not through ſome ſorts of Earthen Veſſels. And (to inſiſt no longer on words than a ſwift glaunce upon the By) we uſe to call them *turgid Spirits* and *rough Spirits*, which are ſometimes nothing elſe but a Heat or Cold encentred in the minute Particles of the Liquor; or thoſe Particles broken into ſharper Figures; Or that ſome Air, which hath a far more vigorous Spring than water, is encentred, compreſſed, and active in or among the parts of Liquor; Or that ſome part of the Liquor is refined into a more Spiritual and Inviſible ſubſtance. And that ſome of theſe caſes, or the like, may fall out in ſubterranean Streams, and other Liquors, I can demonſtrate Experimentally. And then the effect may be this, that the Air, or other Spirits, may be divided in the ſealed Veſſel from the Water; Or the fervid and tumultuous Spirits may ſlacken their Springs, or expire; and ſo the water may grow Languid and ineffectual, either without the falling down of any ſediment, or together with it. That theſe caſes do ſometimes come to paſs, I ſhall now endeavour to prove.

1. Though the particles of water are ſo minute, that we cannot diſcern them with our Eyes, yet by a duller Organ of Senſe, even by Feeling, we may diſtinguiſh the acute and vigorous particles of Healing Waters, from the Languid and hurtful particles of Common waters. The Healing waters will intermingle with their *aſperity's* ſuch an agreable titillation, as will invite us to rub in, or preſſe on the cleanſings and terſive water; And will, all along, recompence the pain of ſearching the wound by their active frictions, with ſuch ſpeedy reparations, and ſuch indulgent degrees of ſanation, as mitigates the Torment with ſtore and variety of pleaſures. Other Common waters, even thoſe of ſome of the pureſt and moſt Chryſtalline Fountains, are almoſt poy-

ſonous, encreaſing Teters and tormenting Ulcers, with an inward and ſullen painfulneſs. This dextrous water, by a moſt favourable Chirurgery, ſearches to the bottom of Old and cancerous Ulcers; ſweeps or ſhaves away the Rootes of Teters and Cancers; and appeaſeth the unnatural rage: And ſome of theſe Healing waters are benigne, whether we apply them outwardly, or truſt them inwardly for the relief of our Entrals and Vitals. And by theſe *remarkable Indications*, and the Effects I have ſeen ſucceeding, I have been confirmed of the real vertue of ſome of the (ſo call'd) *Holy-Wells* of oldeſt reputation in *England*; and have diſcovered other Healing-Springs, whoſe Vertues were not much known, or noted before.

2. And we call in the Teſtimony of the Guſt (which is another of the leſs *ſpiritual* Senſes) to prove the *aſperous*, and yet *appeaſing Particles* in ſome Liquors. *Ligon*, a Gentleman of a curious palate, and Muſical, eſteems the *Queen-Pine* to be incomparably the moſt delicious fruit in the world, and thus deſcribes it: *When we firſt bite it, it is ſo violently ſharpe, as one would think, it would fetch all the skin off the Mouth; but before the tongue can make a ſecond trial upon the palate, as perfectly cures that vigorous ſharpeneſs: And between thoſe extreams of ſharpe and ſweet lyes the reliſh and flavour of all fruits that are excellent: And thoſe taſts will change and flow ſo faſt upon the palate, as Phanſy can hardly keep way with them; and this at leaſt to the tenth examination; for ſo long the Echo laſts.* Thus he: And he ſeems to have in his thoughts an expert Luteniſt, when he briskly ſweetens Diſcords into the livelieſt Harmony. I dare not take the boldneſs here to think on the warbling of a Lute. But, to impreſs the Advertiſement concerning the difference of theſe waters, I abide the longer on the Deſcription: And I durſt not ſay it, if I had not felt my ſelf oftimes, and alſo heard it acknowledged by them that received wonderful benefit from thoſe kind Springs. Therefore I perſiſt thus far in the Parallel; As the Juyce of the delicious fruit playes upon the Organs of Taſt, ſo doth the right Healing water upon the Ulcers: At firſt touch it ſeems to tear the fleſh off deeper, but immediately changes the begining of a deep pain into a deeper pleaſure: And after many aſſaults, and quick ſlidings, the rugoſities of the wounds

or of the Liquor, or of both, are by their dauncing vibrations ſmooth'd into a delightful accord. But let us accept of Vulgarities for the moſt evident Inſtruction in like caſes: When Wine, Cider, or Ale is well botl'd, we feel how auſterely it invades the roof of our mouths and our throats at firſt, and how ſpeedily it repayes with a gratifying ſatisfaction: Yet, neither Minerals nor their Salts, nor other Ingredients are preſumed to enter into the bottels, *whilſt theſe liquors acquire this livelineſs*. This ſeparation of parts, and the enlargement of the Spirits, or ſome alteration of the conſiſtence of the Liquor, may give the improvement here: And ſome ſuch cauſes may exalt the vigor of thoſe Springs, whilſt they are briskly running, and working their way through the Veins of gravel, ſand, and healing Bolus's; Or perhaps rather from ſubterrranean ſteames, which do alſo impregnate the healing Bolus's with their beſt Vertues.

3. Our Eyes alſo may be, in ſome ſenſe, good witneſſes of peculiar figures in the particles of thoſe Spring waters, which are proper for the Eyes. They ſeem to ſcoure the Eyes, as it were, with ſharpe, but very fine Gravel. And by this indication I have tryed and found the Springs which are extraordinary for the Eyes and perhaps to cleanſe Optick Glaſſes. About 30. years agoe, in a very hot and droughty Summer, there was an Epidemical diſtemper of mens Eyes and Eyelids; I found it ſo at *London* and *Weſtminſter*, and almoſt in every Houſe where I came, as I travell'd weſtward on both ſides *Seavern*: Ver-juyce, of the juyce of Crabs, was found the beſt remedy; and where they knew it not, I gave notice of it; and all that tryed it, confeſſed that it was not a very unpleaſing application. Their eyes had a fretting itch; and Ver-juice proved more agreable than Vinegar, or White-wine, or any other liquor, or mixture. Some ſuch tickling pleaſure, but yet more delicate and tender, there is in ſome Spring-waters, which are for the eyes peculiar. Of this indication I gave notice in your *Num.* 20. *pag.* 359. And of the former indication of Healing ſprings, I gave you then a hint, but I know not how it was miſcarryed.

4. The Springineſs of wool, more than of Linnen, offers another viſible and tangible Demonſtration, how the ſtronger and quicker Springs of ſome water, more than of other, may

conduce more or leſs to healing; or may be more or leſs noxious, either inwardly taken or outwardly applyed. Upon this occaſion I remember, the Lord *Bacon* ſomewhere, I think, *in Hiſt. Vitæ & Mortis,* takes notice, that anciently, to preſerve Life in dangerous ſickneſſes, they uſed to remove Linnen, and to let the Sick lye next to the woollen blankets. And I have received it well atteſted, that, *in confiniis mortis*, ſome have had ſpeedy relief from a flannen waſtcoate made of the fineſt wool: They prefer the ſcarlet Dye; I think, my Lord names a Tincture of Saffron with Oyl of Almonds, but I dare not truſt my memory, having ſeen it but once, and that was, when it was firſt publiſhed. Such a woollen garment will drive a warm friction through a ſhirt of fine Linnen, which may anſwer in a gentle degree to Friction, as it is one of the laſt Medical applications among the witty *Chinois*; and among other Nations, who adhere ſtifly to their oldeſt, and beſt tryed Experiments. For the Sanative force of Friction I refer to your *Num.* 12. p. 206, where the Lord *Bacon* is recited to obſerve, *that motion and warmth drawes forth into the parts new Juyce and Vigour* (and theſe are the effects of wool, as they are of Friction) and that *Frictions conduce much to Longevity.* For another purpoſe I add an Inſtance of a much differing kind: I knew one who was ſhot in his heel with an arrow, which carryed with it a very ſmall ragg of the woollen ſtocken: This ragg being not found be the Chirurgions, though they were then of the beſt note, the wound became for a year or two incurable; And the pain was ſo intolerable, that it was thought neceſſary to cut off his foot: At laſt by chance the ragg was found, and taken away, and then the cure was ſoon perfected. Woollen and Linnen may have their turns and ſeaſons; the one as a Mechanical Operation for heating by a cloſe and permanent friction, the other as a quiet Lenitive. Our tender skin can hardly bear the inceſſant Springineſs of Wool; In a deep wound we can leſs endure it. But the Springs of ſome waters may be lined with a ſofter Liquor than the hairy and curled filaments of wool: And hence we may perceive, how ſome waters may by their rolling particles be the greateſt Probes, and yet the ſureſt Searchers, Cleanſers, and Healers. And hence alſo, on the contrary, we may ſee, how ſome waters, which cure Ulcers and Cancers by outward application, may be too buſily corroſive and dangerous, if taken inwardly.

5. To approach cloſer to the main point, I ſhould now deſcend to particulars, and take a more exact accompt of ſome ſingular Qualities in waters. Credible Authors, both Ancient and Modern, do make very ſtrange reports of ſome Fountains and Lakes: And you have given us conſiderable Narratives of the Boyſterous Spring in *Weſtphalia*, and of the Salt Springs in *Germany*, N. 7. Of the Springs in *Paderborn*, *Baſel*, and in *Alſatia*, N. 8. And lately N. 54. of the Lake in *Carniola*: But I muſt not now purſue wonders; I ought here to apply to the point, with ſome diverſions for general uſefulneſs and property, for our own Country. Salt is a part of our food; it ſeaſons all things and (if rightly ordered) aſſiſts Fertility. And *Healing* waters have ſomewhat of the obligingneſs of the divine miracles. And theſe two ſhall be my preſent buſineſs, *Salt* and *Healing* waters;

Parcarumque colos exoratura ſeveras
Flumina: ſaid the Gentile Poet *Claudian*.

6. I think I may note, that generally all the Springs in *England*, that are of very Ancient eſteem for Healing, and were commonly call'd *Holy-wells*; ſuch as St. *Winefrids-well* in *Flint-ſhire* (of which I never made tryal, but it carries the greateſt Fame,) are all very pure, and yield no kind of ſediment. In this, our hot Baths, and perhaps ſome few Mineral Springs, are to be excepted. I muſt yet be more particular.

7. I know a Spring, which the old People there call their *Holy-well*, on the ſide of a low Hill in an Arable Field; which (beſides the Healing Qualities) hath an extraordinary efficacy in clearing the skin from Sun-burnings and freckles; and addeth as much luſtre, as agrees with the finer Art of concealing Art, and with modeſty; And, after waſhing two or three mornings, it makes the skin as ſmooth as Glaſs. It paſſeth through a vein of light Sand, if I may call it Sand; 'Tis more like to ſome kind of blewiſh criſped Marle; 'tis ſo light and hollow, as if it were freſhly working by ſome ferment; and 'tis ſo full of very ſmall and thin *Laminæ*, ſeeming to be Metalline, and bright like the pureſt Silver, that it encouraged me, about 12 years agoe,

ago, to ſend ſome of it to the Lord *Brereton*, who was pleaſed to ſhew it to the Refiners, but they could not find it to be of any value. I was inquiſitive to ſearch it out, whether this water had the beautiſying property from the Silver-like *Laminæ*, or rather gave thoſe veins of Earth that tincture and ferment. Only two things I can affirm; 1. I ſaw many Springs opened in the lower Grounds; and which ſeemed in all appearance to run from the ſame Head, and had alſo the very ſame bright ferment in their paſſages, where they were opened; but theſe had nothing of the ſame property for Healing, or for Beautifying, as I found by many tryals, more than daily for ſome years together. 2. The common Fields adjoyning, had on their clods and Fallowes, ſomewhat of the ſame glittering, much faded, but enough to dazle their Eyes that fixed on it in a bright Sunſhining. May not ſome Subterranean ſteam give the tincture, both to that vein of Earth, through which it paſſed more freely; and alſo more forcibly to that Spring by a greater reſort, or by ſome advantage it got by the aſcent of the Ground? (And we commonly find theſe healing Springs, either near the top, or on the ſide, or near the foot of ſome Hill, or running from the Hill:) And thus the ſteams reverberated and daſhed down by the Motion of the Air, and by the weight of the Atmoſphere, may beget the ſame Metalline tincture in the adjacent Fields. *This* was far enough from yielding ſediment, and it had a pleaſing ſmoothneſs; and was very inoffenſive to the ſtomach; but it ſearched the Eyes ſomewhat ſmartly, and cleared them ſpeedily, and was generally commended for many healings, both inwardly, and outwardly; And was every way much more pleaſing than tormenting. The Villagers, to whom the Spring belongs, being conſtantly healthful, and having other affairs than to beautify their skin, they take the leſs notice of it; but if it were in Hide-Park, or More-fields, it might be valued above the richeſt Canary.

8. Within two Miles of the ſame, is another of their old *Holy-wells*, on the brow of ſuch another Hill in an Arable Field, within half a Mile of a lofty Hill: This is very kind for the Eyes, and hath alſo done many cures upon putrid and ſoetid Ulcers, which were many years deplored for incurable, as I can affirm upon my own knowledg: I have ſeen it tryed often, and alwayes to good

effect; ſometimes conſiderably wonderful. This is the ſame Spring, which I meant in my *Numb.* 20. near the end of p.358. where by ſome miſtake of my hand (for it was then very bad) it is not diſtinguiſhed from the other Springs there mentioned, or intended. Many drink of it, and much extol it for healings: And I never could heare of any that complained of hurt done by it. It was ſomewhat aſperous, but pleaſing in malignant vlcers.

9. But much greater is the reputation of the *Holy-Wells*, as they call them, on the ſide of *Malvern* Hills, which Hills divide *Worceſtire*-ſhire from *Hereford*-ſhire. The higher Spring is peculiar for the Eyes; *About a furlong lower is the Healing Spring* (which laſt halfe line was omitted in the Print of your *Numb.* 20. p. 358, l. 22;) this cureth many Maladies and Cancers, if applyed before the ſtrength of Nature be overthrown. I have read in the Monuments belonging to the Hoſpital at *Ledburg*, a Town in the way from *Hereford* to thoſe Springs, that a Biſhop, ſome Ages paſt, endowed that Hoſpital with revenues, for the entertainment of diſtreſſed Paſſengers that travayled to thoſe Springs for relief. 'Tis above 50 years ſince I heard a Panic ſtory ſpread all over the City and Country of *Worceſter*, that the Phyſicians had poyſoned thoſe Wells. I am perſwaded, that the ground of this Fable was only thus: After more than ordinary Rain for one, two, or three years together (as it falls out ſometimes in *England*) ſome common waters, by a part of the ſame, or ſome other channel, do drive to the ſame apperture, and drown the excellency of the healing Water. In this droughty year we find, that many excellent Springs have loſt more than half, and ſome more than four parts of five of the waters which they did uſually afford in the ſame ſeaſons of other moyſter years; and the remaining waters have the ſtronger efficacy. Of this expectation from long Droughts I adverts'd you *N.* 20. p. 358. And 'tis *now remarkable*, that theſe better Springs, which are on the ſide of Hills, and on the higher ground, do maintain their current much better, than thoſe which are in the lower Vale. 'Tis ſo in many places about us here; when the better Springs had loſt 4 parts of their current, many of the lower Springs were quite dryed up. This advantage (by the Drought) emboldened my preſent adventure, there being now leſs peril, that my Teſtimony can be refuted. But Fooliſh people go ſweating up the Hill, and then drink the cold water; or apply it Cold to their heated Ulcers, and then what good can be expected? And (withal) theſe waters are kindeſt to the Poor and jejune people, who are accuſtomed to drinks almoſt as weak as water. So the Air in *Bermudas*, and near *Florida* in *Virginia*, preſerves them that are addicted to a ſimple and Natural Diet, without ſickneſs; and frequently to the Age of an hundred years; whilſt the Wealthy (as perhaps more habitually accuſtomed to Brandy, or ſome high and plentiful Diet) have neither firm health, nor long Life. Thus Mr. *Stafford* in your N. 40. p. 794: And the like is reported of *Braſil* by *Piſo* and *Bontius*. No Salubrity of Air, or Medicine of the pureſt water, can recover health or ſecure long life to them that are exceſſively luxurious. All theſe waters are purely limpid, free from all ſediment, very terſive and ſearching, and moſt effectual at the Spring-head.

10. I omit many other Healing waters, that I may give you a brief touch of ſuch Mineral, Saline, and Medical waters, as I have found, or heard of, in our Neighbourhood; Namely about *Yeavil* in *Somerſetſhire*. I lately hear of two more Mettalline Springs in *Dorcetſhire*, beſides that of *Farrington*, analyſed by Dr H. in your N. 56. Perhaps their vertues and their Fame are encreaſed by this drought. The *S*aline *S*pring there mentioned by Dr H. to be at *Eaſt-Chenock*, is about 3. miles hence Weſtward. In a very Droughty *S*ummer I found it ſtrong Brine. But there is a *S*alt-*S*pring of far greater worth at *Everich*, about 12 miles hence towards *Shepton-Mallet*: of this I will owe you a concernment. The Pool, which yieldeth the Vitriolate *S*alt, which I ſent you, is in *Sock-Denis*, 3 or 4 Miles hence weſtward. 'Tis not a great Pool, not above 10. foot ſquare. Whether the *S*alt proceeded from a *S*pring, or from a vein of vitriolate Earth, I cannot yet determine; the Pool having not been drayned ſince I extracted the *S*alt, though I expected it, when I gave you the notice, recorded in your N.18. p. 323. The Mud and Earth about it is as blew as any Roman Vitriol. In a long-laſting and hard Froſt, I ſent for a Quart-Bottle of the water, and found it very thick, and blackiſh, and it ſented

ted intolerably ſtrong, not much unlike Gunpowder newly inflamed. Cloſe adjoyning unto this Town of *Yeavil*, were two Springs kind for the Eyes; the one in a *Paſture*, the other within a Bolt-ſhoot in a Field. The Old *People* prefer that in the *Paſture* before the other, as they have it from Elder Tradition, and their pretended experience: And at this time, the more commended Spring, which is in the Paſture, and on the ſide of a riſing Ground runs freely; the other is newly dryed up. 'Tis not every ſlight Gravelling of the Eyes that ſufficiently Indicates an extraordinary Eye-water: Many good Springs have a degree of Terſiveneſs; but that which is extraordinary, hath a Friction ſomewhat permanent, and is in the end gratifying. We have alſo, cloſe by our Town, a Spring called *Ruſty-well*. Where it breaks out, and where it firſt falls, it tingeth the ſtones of the Colour of Ruſty-Iron, and it hath the ſmell ſtrongly, (and ſeemeth to taſt) of Ruſty-Iron. Yet 'tis as clear as any water; and I tryed it for a Moneth or more in my ſtudy, putting Corniſh-ſlate and Pebles to it in a Glaſs; and it gave no tincture at all to the ſtones, nor any ſediment; So that I ſuſpect the tincture to proceed from ſome *Effluvium* mingled with the water at firſt opening: But I confide not much in the ſingle and ſhort tryal I made. Some Old men boaſt of many great cures it hath done. I dare ſay nothing for it, or againſt it: Neither do I know, whether I ſhould call it Metalline, or Anti-Metalline, ſince Ruſt is the *Putrefaction* and deſtruction of Iron. Our Fore-Fathers, and very Old men, ſcarce heard of the name of the *Scorbute*; Tis a ſeaſonable providence, if, ſince that diſeaſe is become ſo *Epidemical*, the remedy ſhould be ſo Obvious and Vulgar, as is pretended to be, by ſuch ferrugineous Springs. This breaks out near the foot of a lofty hill, which continues, with ſome leſſer falls, about 3 miles weſtward to *Hamden Quarre*, where they dig a hard free ſtone of a dark yellow colour. At *Weſt-Camel*, five miles hence Northward, is a very fætid black Spring, which tingeth Silver black immediately; and I am told, that about 10 miles hence, more Eaſtward, near *Wine-Caunton*, not many years agoe, they digged for Cole, where the Colemen were endangered by a fætid damp; And when they aſſayed the Cole in the fire, it proved very noyſom, ſo that they forſook thoſe Cole mines, Perhaps it may be ſerviceable to them that know how to make an honeſt uſe of Arſenic and other poyſons,

11. Here again, with ſome timorouſneſs, I propoſe the Inquiry, whether Subterraneous ſteames might not give the dark yellow tincture to the *Hamden Quarre*, and the property to this water of *Ruſty well* for the fulvous coloration: It cannot be expected, that Materials, differing ſomuch as ſtones ſeem to differ from water, when perfectly petrifyed, ſhould retain the very ſame Colour, though both received it from the very ſame ſteames. The ſame I propoſe for the blackneſs and fœtidneſs of the Spring in *Weſt-Camel*, and of the Cole near *Wine-Caunton*; that both may receive the ſame tincture, and odour from Subterranean ſteames, which may perhaps be of ſo many kinds, and mixtures, as to cauſe much of the great diverſities of Metals, Minerals, Earths, and Soyles; and of ſome minute differences in the Colour, Taſt, Odour, and dreſs of Vegetables; Yea and of the Furres, Hayres, Wool, and other little varietyes in Animals (particularly in ſheep) in *ſeveral places*; more immediately in Vegetables, and of Animals by remoter circumſtances, I will not except the *Ethiopick hue*, and humors of men in diſtant Climates; though Vegetables and Animals do (for the moſt part) retain their ſeminal properties in diſtant Climates for many generations: and perhaps from theſe terreſtrial ſteams the Vegetables do imperceptibly draw ſome of their Salts, and much of their nutriment. Theſe things I dare not affirm, nor ſay much more, till I ſee fit time and place to offer my reaſons and other Obſervations.

12. For theſe Overtures I will at preſent inſtance no more than thus. The Illuſtrious Mr *Boyle* hath, methinks, evinced, that the moſt ſolid Bodyes we know, have their Atmoſpheres of ſteams and Exhalations: And whatever the Materials be, which are under our Terrene cruſt towards the Centre, whether fluid, flaming, or groſs Subſtances, they muſt needs hold an Intercourſe of tranſpirations, and mutually operate by their perpetual agitations, and whirlings about: And by the *Vulcano's*, frequent in *Japan*, and to be ſeen in ſeveral other places, and by the heats in deepeſt Mines, and by many other ma-

nifeſt Arguments, it appears, that there are alwayes ſtrong ſteams aſcending towards the ſurface of the Earth : And, if their Generative power, and other efficacyes were duely examined, and proſecuted to the beſt purpoſes, we might perhaps in time find them to have a greater vertue, and more uſeful for us, than many of the Conſtellations and Celeſtial Influences, which make no ſmall noyſe amongſt Aſtrologers.

Of theſe, we are ſure, and they are in many reſpects manageable ; But of *thoſe*, which are ſo far above our reach, learned men are to this day, after ſerious Diſquiſitions, at a demur, whether they concern us at all, or not. We do not compare with the Solar Influence, which doth almoſt all that we ſee done in Nature; And more perhaps than we have hitherto conſidered, as hereafter I may propoſe to you. Next to this, nothing is more frequent amongſt the Ancient, than Obſervations upon the Lunar Influences ; Many more, than are ſufficiently confirmd by later phanſied experience. *'Tis phancied* that ſhee is Queen of the wateriſh, Cooling, and Feminine Regions : But tis certain, that the Sun is the Maſculine Lord, not only over the fiery and dry Regions, but alſo over the Moon and all her Dominions. And yet tis ſomewhat ſtrange, that the ſtrongeſt Solar Beames ſhould be ſo totally drencht and quencht in the disk of the Moon, that by all our contrivances of the niceſt *Thermometers*, and beſt burning Inſtruments, we can have no perception of any degree of Heat ; not in the brighteſt and fulleſt Rayes of the Sun, reflected to us by the Moon, though we can hardly Imagine Light it ſelf to be any other thing than the pureſt Flames of Fire. Hence I wiſh a ſevere attention on both hands both to *Terreſtrial Steames*, and to Celeſtial Influences, (as the manner now is) impartially, without foreſtalment, or prejudice. I have in my aim, though not in my preſent power ſome expedients, which under one may be accomodable to both Intentions. For theſe two Conſiderations, the one in the higheſt eſteem among the Ancient ; and the other ſeeming moſt Improveable by modern Induſtry, I have been conſtrained to be ſo tedious, as now I have been.

13. But it is full time to ſum up here, what hath been attempted in this Diſcourſe; and to take up the reſult. We have found ſome Mineral Springs, and have not denyed, that they may in their Channels have gathered up Metalline Salts ; ſometimes perhaps, where no Metals are yet formed ; yea, and where they are never like to be formed, for want of appoſite materials. Alſo, we have not ſeen cauſe to deny, that thoſe Mineral Springs may have acquired, as the lately mentioned Springs have done, ſome other healing properties, beſides thoſe that are from Mineral Vertue : And thence we may allow, that ſome of thoſe finer and unknown Spirits, may, by reſt or other accident, ſoon divide from the water, or dye there, or expire through any ſealed Veſſels. This we muſt grant, that as the particles of all Liquors do more or leſs ſutably agree with the Orifices of the Tongue, and Pallate, and thence beget the delight, or diſlike in the reliſh ; ſo the like effect all Liquors have upon our raw fleſh and deep wounds : And ſome Ulcers have need of a more active Friction to clear them, and to extirpate their very roots, and foundations.

Now for the words ——*whatever theſe Spirits be* &c. N. 51. p.1039. they may have more aſpects, than are taken notice of in the ſagacious reflexions ; and the warineſs of ſuch expreſſions may well be excuſed in an Age, that is too apt to entertain malicious ſuſpicions againſt Phyſitians, and Philoſophers ; But tis good to be ſilent, or very modeſt in matters which we can neither affirm nor deny upon clear ground ; eſpecially when the full debatement cannot be confined within the Sphere of Phyſiology : Therefore *Manum de Tabula*. What is hitherto but timorouſly intimated, may perhaps be more throughly proſecuted in ſome other Eſſays, if this tediouſneſs be forgiven.

Some Obſervations, Directions and Inquiries Concerning the Motion of Sap in Trees, in purſuance of what was formerly begun therein, about the latter end of 1668. and the next following Spring, by Dr Ezerel Tonge, *and* Francis Willoughby *Eſq;*

We ſhall here begin, according to the order of time; with the late Communications of D. Tonge, *which are as follows;*

I Now begin my Inquiries and remarks upon the laſt publiſht Obſervations of thoſe Ingenious perſons Mr *Willoughby* and Mr *Wray* in your *Ph. Tranſact.* N. 48. *June* 21. 1669, And *Firſt*, to the 3d and 4th Experiments I propoſe this Inquiry; At what Seaſon of the year, Month, day, and in what wind and weather, Branches and young Trees (eſpecially ſmall Branches) are ſo full of Sap, that, being held perpendicular, they will bleed at both ends, as is there related; and Roots, both wayes? And what gage the Barometers and Thermometers then held? And in what forwardneſs their Buds and Leaves, or Chats were then ſhot, or broken? And of what Diameter ſuch Roots were?

The latter part of the 4th Experiment *appearing* ſo manifeſtly to diſagree with ſome Experiments, I have made this Year, as well as formerly, in Roots and Branches of Trees; whereby I found, that not only Cold weather, but Cold Wind and Sun-ſetting ſtopped or abated the Motion of Sap in the Sycamore: Which puzleth me, how to direct an Inquiry to find out the Cauſe of this ſingular Experiment, and of the Obſervations alſo in the 11th Experiment, which highly confirms this. The beſt directions I can at preſent deviſe, (untill the Experimenters ſhall pleaſe to give us an accompt of the Time, Seaſon, and that not only by the Month, day, hour, but alſo by the wind, and the motions of the weather-glaſs, before, after, and at the inſtant of thoſe Obſervations;) are the enſuing; which we ſhall conclude with ſome other inquiries.

1. What the difference of the Seaſons of that Experiment was from the foregoing? 2 Whether the *Heat* were ſo great, when the Sycamores ſo ſenſibly abated, that it coagulated their Juyce, and, by thickning it into Jelly and ſo into wood, ended the running? And therefore 3. Whether this *Experiment* of Cold, promoting, and of Heat, ſtopping the bleeding, were not in the later end of their running only, and not in the former? And if ſo, Whether 4, the riſing of Sap be not rather to be attributed to the *Degree* of heat, than the *Abatement* of Heat? 5. Whether the reaſon, that the *Birch* increaſed, when the *Sycamore* abated, be not alſo to be imputed to this, that the Birch runs not ordinarily till *March* (unleſs in a forward ſeaſon) and the Sycamore and leſſer Maple in *January*; and ſo the ſeaſon of the ones Sap, beginning ſooner, doth alſo end ſooner: And whether thereupon it be not obſerved, that the ſeaſon of the Birches Jellying into wood will not commence till a greater heat, as that of *May*; whereas the Maple-Sap probably will condenſe to Jelly and wood in a leſſer heat, as that of *March* going out, or *April* beginning? 6. Whether this be not alſo probably the reaſon of what is obſerved in the 12th Experiment in the ſame N.48. *viz.* the *Sycamores* running more on the *North*, and leſs on the *South*-ſide, contrary to my yeſterdayes Obſervation (*March* 1. 16$\frac{69}{70}$.) the Southern branches yet dropping in the afternoon when others ceaſed? 7. Whether the *Birch* alſo in ſuch ſeaſons, after the *Maple* and *Sycamore* ceaſe running, will not bleed more in colder weather, ſuppoſe in the middle or beginning of *May*, or latter end of *April*, and ſo verifie my Experiment of the *Sycamore* running in hotter, and ſtaying in colder ſeaſons, or in the ſign *Piſces*, the latter end of *February*, and the beginning of *March*; and on the contrary, running in colder and ſtaying in hotter ſeaſons, *viz.* of *Aries* or the latter end of *March* and the beginning of *April*: Or briefly, In what *Signes*, and what weather as to wet and dry chiefly, the *Birch* and *Maple* bleed in hot, and ſtay in cold weather, & *vice verſa*? Which temper of weather I would have accurately obſerved by Weather-glaſſes and Barometers. 8. If this be found to verify my Conjecture, then Whether by the running and ſtaying of theſe Trees, and the firſt riſing and ceaſing of their Sap, may not probably (in ſome meaſure, by diligent Obſervation and comparing Ob-

ſervations of time, ſeaſon, weatherglaſſes,) be found the difference of Climats, Land, and Scituation; as alſo of Years forwardly or late fruitful, or of years unfruitful? 9. Whether the Obſervations of *Quality* as well as *Quantity* of *S*ap by Diſtillations after fermentation, &c. may not alſo conduce to the Prognoſtique of the Fruitfulneſs or Barrenneſs of a year, eſpecially in *Walnuts*, and ſuch Fruit-Bearers as yield plenty of *S*ap, and by analogy and obſervation from them to others: As (e. g.) whether a fruitful or unfruitful year of Hazel or Filbert-nuts may not probably be diſcovered by their *S*carlet-bloſſoms, not appearing this year till now? (*March* 2.) 10. Whether Ablaqueation (or digging about and baring the roots of Trees) will retard the riſing of Sap in the Walnut *&c.* and what other effect it will have on fruit, &c? And whether ſuch Baring of Roots of Pear, Plum and Cherry-trees (which are as much forwarder than Apples, as Maples are than Birch *&c.*) and generally of all forwarder Trees, ſhould not be made in different ſeaſons (accordingly) from Mulberries and ſuch like? 11. VVhether Amendment of ground, laid after the Sap ceaſeth, be not fruitleſs as to that year, or much leſs beneficial than what is layd before? 12 Whether the ſeaſonableneſs of watering may not be found and promoted by a right Inquiry, and by a due ſatiſfaction to theſe Queries? 13. Whether Ablaqueation, watering, Amendment; &c, according to theſe ſeaſons, may not be ſo directed, as to encreaſe Fruit, Wood, or both, or either at pleaſure? 14. Whether Ablaqueation, which ſo alters the riſing of Sap, that it curdles them, when it ſhould run, doth not hurt? 15, Whether the ſame hath influx on the Leaves, Suckers and outward products of the Tree, or on the inward alſo, as fruit; or only increaſes their quantity, by accident hindring the growth and draught of other parts which did robb the fruit? *16.* Whether the Cool ſeaſons of the Night afford not ſome temperament in theſe caſes, ſo that thereby, as tis in cool ſeaſons, the Sap runs and Jellies by day, as it runs by night? 17. Whether in ſome warm days, in which the *Sycamore* runs not at Noon or in the heat of the day, it run in the Night, or the Cool of the day, and, on the contrary, the *Birch* run by day or about Noon, and ceaſe at Night or Sun-ſet, in the ſame ſeaſons? 18. The ſame Queries might alſo be proſecuted in the Hop, which runs after the extream heat of the Summer, after the *Hops* are ripe and gathered, or any other Plant, that runs in Summer or Autumne, if there be any ſuch.

So far the Inquiſitive Doctor for this time: To which we cannot but ſubjoyn the Letter of that Worthy and Obſerving Gentleman, Mr. VVilloughby, *containing an Anſwer to ſuch of the precedent remarks and Inquiries, as concerned him, and therefore were imparted to him. It runs thus.*

*S*ir, 'tis no wonder, that Dr *Tonges* Experiments concerning the Bleeding of the *Sycamore* do not agree with ours, they being made in a different ſeaſon; his, in *February*, and ours towards the end of *March*, viz the Cold, which cauſed the Increaſe of the bleeding in the *Sycamore* and *Walnut*, hapned upon the 23. 24. 25. 26. *March*; and one *Sycamore*, which ceaſed to bleed from the 11th of the ſame Month, bled afreſh copiouſly from wounds that had been made ſo long before: The Buds before the cold were Juſt ready to open into Leaves, and the Sap had begun to coagulate above a fortnight before. This year, making inciſions in the *Sycamore* and common Maple, in *January*, immediately upon the relenting of the firſt Froſt, we found that they both bled, and faſter, as the weather grew hotter; nor did the ſucceeding Cold promote, but rather hinder their bleeding. *S*o that the Learned Doctor doth moſt ingeniouſly conjecture, that the Aſcent of *S*ap in Trees depends upon a certain Degree of heat, ſufficient to *raiſe*, but not to *coagulate* their reſpective Juyces. In thoſe Months, wherein the Heat *ordinarily* falls ſhort of that Degree, an accidental heat or warmth of weather promotes the bleeding; but in thoſe Months, wherein the ordinary temper of the Air exceeds that Degree, an extraordinary fit of colder weather makes them bleed again.

The Experiments concerning the *Northern* and *Southern* ſides of *S*ycamores were made at the ſame time; and are well ſolved by the ſame *Hypotheſis*.

In *Walnut*-trees, we never yet found, that Heat promoted their bleeding, but always Cold. From a wound, made in a *Walnut*-tree, in *January*, and the beginning of this preſent *March*, in mild weather, nothing iſſued; but the weather changing and growing colder, it bled plentifully: Which ſeems not well to conſiſt with that Hypotheſis, and muſt be better examin'd.

Laſt year the 6th and 7th of *March* we made the Experiments of the Bleeding of Poles (held perpendicular) at both ends, in Willow, Birch, and Sycamore: which may ſo eaſily and certainly be found to ſucceed, in a great latitude both as to the bigneſs of the boughs and temper of the weather, in the beſt Bleeding ſeaſon, that there needs no ſuch exact niceneſs in the Obſervation of thoſe particulars. The 11th of *March*, Roots of Birch, great and ſmall, bled both ways; and about the ſame time, Sycamore roots alſo. Of all which I doubt not, but Dr *Tonge* is by this time fully ſatisfyed by his own Experiments. The ſame Birch, which firſt began to bleed the 3d of *March* this Year, bled 3 weeks ſooner laſt year.

Tryal would be made, whether Cold will diſſolve the Sap already coagulated: Elſe it will be hard, in the Doctors Hypotheſis, to give an accompt of the Trees dropping a new in Cold weather.

It was laſt Autumne obſerv'd by our ingenious Friend Mr *Martin Liſter*, that upon the firſt Froſt, which hapn'd in *November*, a Sycamore bled copiouſly; ſo that the Sap cannot be ſaid to riſe in *January*, but immediately after the Fall of the leaf, in this Tree.

Our Experiments, which you have already printed, are moſt true, and according to the Doctors Hypotheſis, will very well agree with his. His Deductions and Inquiries are very rational and well deſerve to be made publick. Various interruptions have hindred us from the diligent proſecuting of theſe Experiments this *Spring*; which that I may more critically make hereafter, I muſt procure two Sealed Thermometers and two Barometers. I am &c. Dat. Middleton in Warwick-ſhire *March* 12. 16$\frac{69}{70}$.

Some

Some Conſiderations

Of Mr. Nic. Mercator, *concerning the Geometrick and direct Method of Signior* Caſſini *for finding the Apogees, Excentricities, and Anomalies of the Planets; as* that *was printed in the* Journal des Scavans *of* Septemb. 2. 1669: *which Conſiderations are here delivered in the* Latine *Tongue, wherein they were written by the Author, as chiefly regarding the Learn'd in Aſtronomy*, viz.

Clariſſimi Caſſini *Methodus*

Inveſtigandi Apogéa, Excentricitates & Anomalias Planetarum, breviter Expoſita & Demonſtrata.

Supponit Cl. *Caſſinus*, ad Planetam in Ellipſi moventem extendi ab utroque foco duas rectas, quarum altera ſit *medii*, altera autem *veri* motûs linea. Conſtructio porrò talis eſt;

Fig. II. L eſt Centrum Concentrici ABCDE.
BLD eſt Diameter.
BA, BC, BP, ſunt intervalla apparentia.
DE, DF, DQ, ſunt intervalla mediorum motuum.
BE, BF, BQ; item DA, DC, DP, ſunt lineæ rectæ.
BE ſecat DA in H; BF ſecat DC in G; BQ ſecat DP in R.
RHG eſt linea recta.
BI eſt perpendicularis ad RHG.
I eſt Centrum Ellipſeos.
LI eſt Excentricitas.
$IO = LI$.
O eſt focus, circa quem ordinatur medius motus; L, circa quem verus.
$IM = IN = LB$.
M eſt Apogéon; N, Perigeon; BLM Anomalia vera.

Demonſtratio.

I. Illuſtriſſimus ac Reverendiſſ. *Sethus Wardus*, quondam in Celeberr. Acad. *Oxon.* Profeſſor Aſtronomiæ Savilianus, nunc Epiſcopus Sarisburienſis, in *Examine Aſtronomiæ Philolaicæ*, edito Oxon. A. 1653. c. 6. docuit Methodum, ex data Anomalia *media* Planetarum, inveſtigandi *veram*; quæ eſt hujuſmodi:

Fig. III. C, eſt Centrum Ellipſeos AEP: F, focus, circa quem ordinatur medius motus. S, focus, circa quem ordinatur verus motus. A, Apogéon. P, Perigeon, E, Erro ſive Planeta. AFE, Anomalia media. ASE, Anomalia vera. FET, linea recta, $ET = SE$. ST eſt linea recta.

In △o SFT dantur, 1. SF diſtantia focorum: 2. $FT = FE + ES = AP$. 3. AFT, angulus externus, ſive Anomalia media, æqualis ſummæ angulorum FST & T. Ergo inveniri poteſt FSE, ſive Anomalia vera, æqualis differentiæ Angulorum FST & T. Nimirum

Ut ſemi-ſumma laterum F T & F S, ad ſemi-differentiam eorundem;
Ita Tangens ſemi-ſummæ angulorum F S T & T, ad Tangentem ſemi-differentiæ eorundem.

Sed ſemi-ſumma laterum F T & F S invenitur, ſubſtituendo pro F T æqualem AP, cujus ſemis eſt AC, qui additus CS ſemiſſi ipſius F S, facit Semi-ſummam AS, diſtantiam Planetæ maximam.

Tum, ſi ex ſemi-ſumma A S auferatur latus minus F S, reſtat ſemi-differentia laterum F A, æqualis PS, diſtantiæ Planetæ minimæ; ut ſit

Regula ex Anomalia *Media* data inveniendi *veram*:

Ut A S, diſtantia Planetæ maxima, ad PS, diſtantiam minimam;
Ita Tangens dimidiæ Anomaliæ mediæ, ad Tangentem dimidiæ Anomaliæ veræ.

Corollar. I. Si continuetur S E uſque ad U, ita ut E U ſit = ipſi F E, & tota S U = Axi AP; erit $\triangle^{i}$ F S U angulus U ſemis Proſtaphæreſeos F E S, ideóque æqualis ſemi-differentiæ angulorum Anomaliæ mediæ & veræ, h.e. ipſorum A F E & A S E; & externus A F U = ſemi-ſummæ eorundem A F E & A S E angulorum, ablata ſcil. ſemi-differentiâ U F E ex majori AFE. Unde oriuntur duæ Analogiæ:

1. Ut Sinus ſemi-ſummæ Anomaliæ mediæ & veræ A F U, ad Sinum ſemi-differentiæ eorundem, U; Ita S U (= axi tranſverſo A P) ad S F, diſtantiam focorum.

2. Ut Sinus ſemi-ſummæ Anomaliæ mediæ & veræ, A F V, ad Sinum Anomaliæ veræ F S U; Ita S U (vel axis A P) ad F U, ſubtenſam Anomaliæ veræ: Ita quoque ſemi-axis A C, ad ſemi-ſubtenſam U X, vel F X.

Corollar. II. Si in eodem Triangulo F S U, ex ſubtenſæ F U puncto medio X, erigatur perpendicularis X E; ſecabit illa S U in duas partes, quarum altera U E = eſt lineæ medii motûs F E, altera verò S E eſt ipſa linea veri motûs.

II. Fig. IV. Sit *a* Centrum Concentrici *c b f i*.
e a d, Diameter, eadémque linea Apſidum.
e h, Arcus Anomaliæ veræ, cui reſpondet
d i, Arcus Anomaliæ mediæ. Itaque
c d h, eſt Angulus dimidiæ Anomaliæ veræ, &
d c i, Angulus dimidiæ Anomaliæ mediæ.
c i & *d h* ſunt lineæ rectæ, ſecantes ſe mutuò in *g*.

Ab Interſectionis puncto *g* demittatur ad *c d* perpendicularis *g b*. Erit igitur,

db . bg : : Radius ad tang. *b d g* vel *c d h*.
Et *cb . bg* : : Rad. tang. *b c g* vel *d c i*.

Ergo $db \times$ tang. $cdh = bg \times$ Rad. $= cb \times$ tang. dci.

Quare $db \,.\, cb ::$ tang. dci, tang. cdh; hoc eſt, db erit ad cb, ut tangens dimidiæ Anomaliæ mediæ ad tangentem dimidiæ Anomaliæ veræ; adeóque (per Regulam ſupra expoſitam) ut diſtantia Planetæ maxima, ad diſtantiam minimam. Quamobrem $db =$ erit diſtantiæ Planetæ maximæ, & cb, minimæ, & ab, excentricitati.

Cúmque idem eodem modo demonſtretur de cæteris omnibus Interſectionum punctis, nimir. Perpendiculares ab ipſis ad cd lineam incidere in punctum b; oportet, ut recta, jungens ipſas Interſectiones, congruat perpendiculari bgf.

III. Ductâ diametro hak, fiat arcus $kl =$ arcui id, & ducantur kc & hl, ſecantes ſe mutuò in p. Ab h in bgf demittatur perpendicularis hr, eadémque parallela Apſidum lineæ cd; erit angulus rhs ſemi-differentia arcuum Anomaliæ veræ ch, & mediæ di. Tum ab eodem h puncto ducatur recta $h\beta$, faciens cum kh angulum $=$ angulo rhs, & occurrens lineæ Apſidum in β. Erit $\triangle^{i}$ $a\beta h$ angulus βah menſura arcûs ch, ſive Anomaliæ veræ, & βha ſemi-differentia Anomaliæ veræ & mediæ (ex Conſtructione;) & externus $c\beta h$ (æqualis duobus internis & oppoſitis βah & βha, adeóque compoſitus ex Anomalia vera & ſemi-differentia ejus à media) erit ſemi-ſumma Anomaliæ veræ & mediæ. Ergo, per *Corollarii* I^{mi} Analogiam priorem; Vt Sinus $c\beta h$, ad Sinum βha; ita Radius ah, ad Excentricitatem $a\beta$. Sed ſupra demonſtravimus quoque ab æqualem Excentricitati. Ergo punctum β congruit puncto b.

Tum ex b excitetur ipſi hb perpendicularis bt; Aio, hanc continuatam incidere in punctum Interſectionis p. Nam Triangula rhs & bht ſunt ſimilia, ex Conſtructione; quemadmodum & $\triangle^{m}$ hpk ſimile eſt $\triangle^{o}$ hgi, cùm eidem peripheriæ ch inſiſtentes anguli pkh & gih ſint æquales, nec non æqualibus peripheriis kl & id inſiſtentes anguli phk & ghi æquales; quare & tertius hpk æqualis eſt tertio hgi. Et ex æqualibus phk & ghi ablatis æqualibus bht & rhs, reſtant æquales phb & ghr. Vnde ſic arguo: $srh = tbh$, & $rhs = bht$, Ergo $hsr = htb$; ergò & Complementa horum ad ſemi-circulum ſunt æqualia, nimir. $rsi = btk$; & $stg = tkp$, Ergò & $igs = kpt$, quibus ablatis ex æqualibus igh, & kph, reſtat $hgs = hpt$; & $ghr = phb$, Ergo & $hrg = hbp$ Sed hrg eſt rectus, Ergò & hbp rectus eſt. Cùm verò & hbt rectus ſit ex Conſtructione, erit tb in directum ipſi bp. Cúmque idem eodem modo demonſtretur de quavis alia Interſectione linearum ab h & k ad congruentia Anomaliæ veræ & mediæ puncta ductarum; patet, non modò rectam, jungentem interſectiones, tranſituram per b punctum; ſed & hb, lineam perpendicularem fore ad eandem Jungentem. *q. e. dem.*

Corollarium. Si à quovis puncto Anomaliæ veræ, puta h, ad reſpondens punctum Anomaliæ mediæ i ducatur recta hi; excitata è Centro Excentrici b, ipſi cbd perpendicularis bf ſecabit ipſam hi in s eâ ratione, quam linea *medii* motûs obtinet ad lineam *veri* motûs.

Nam per *Corollarii* I$^{\text{mi}}$ Analogiam poſteriorem, hb eſt ſemi-ſubtenſa; Ergò per *Corollarium* II$^{\text{um}}$, perpendicularis erecta ex b, nimir. bt, ſecat diametrum hk in t eà ratione, qnam linea medii motûs obtinet ad lineam veri motûs. Ergò & rs (ſive bf) ſecat hi lineam eadem ratione in s; propter demonſtratam modò figurarum $tbhkphb$ & $srhighr$ ſimilitudinem.

Cæterùm ex laudata ſuperiùs Reverendiſſ. *Wardi* Methodo inveniendi primam inæqualitatem, non eſt difficile, alium adhuc modum inveſtigandi Apogéa & Excentricitates, non minùs directum & Geometricum, & Obſervationes *quotvis* admittentem, producere; quem & paucis exponam. Plures modos invenient Aſtrophili in Reverendiſſ. Viri *Aſtronomia Geometrica*, edita *A.* 1656, ad quam eos remitto. Interim

Fig. V. Sint l & d duo foci Ellipſeos; t & u duo puncta *veri* motûs Planetæ; arcus Ellipſeos tu ex l ſpectatus ſub angulo tlu, & ex d, ſub angulo tdu; item diſtantia focorum ld ex t ſpectatus ſub angulo dtl, & ex u, ſub angulo dul: Aio, differentiam angulorum tlu, tdu, æqualem eſſe differentiæ angulorum dtl & dul.

Cùm enim trianguli lux tres anguli ſimul ſumpti æquales ſint trianguli dtx tribus angulis ſimul ſumptis; ſi auferantur utrinque æquales lxu & dxt, reliquorum duorum ſumma $ulx + lux$ erit $=$ ſummæ reliquorum $tdx + dtx$, & ab his æqualibus ſummis ſi auferantur inæquales, v. g. ulx ex priori, & tdx ex poſteriori; reliquorum, lux & dtx, differentia $=$ eſt differentiæ ablatorum ulx & tdx; quod erat propoſitum.

Centro l, intervallo axis tranſverſi mn, deſcribatur Circulus abc, cujus arcus ab rurſus ex l ſpectatur ſub angulo alb, & ex d, ſub angulo adb; item diſtantia focorum ld ex a ſpectatur ſub angulo lad, & ex b, ſub angulo lbd. Ergò rurſus differentia angulorum alb & adb $=$ eſt differentiæ angulorum lad & lbd. Sed per *Coroll. I.* angulus lad ſemis eſt anguli lud, & angulus lbd ſemis anguli ltd. Ergò horum angulorum lad & lbd differentia $=$ eſt ſemi-differentiæ angulornm lud & ltd; ergò & angulorum alb & adb differentia $=$ eſt ſemi-differentiæ angulorum ult & udt, quorum prior eſt intervallum apparens duarum Obſervationum, poſterior autem, intervallum motûs medii. Datâ igitur horum intervallorum differentiâ, datur quoque hujus (*differentiæ*) ſemis, nimir. differentia angulorum alb & adb. Sed alb idem eſt cum ult dato; Ergo datur quoque adb angulus, ſub quo peripheria ab ſpectatur ex d.

Simili modo oſtendetur, differentiam angulorum *t l y* & *t d y* æqualem eſſe ſummæ angulorum *l t d* & *l y d*; nec non differentiam angulorum *b l c* & *b d c* = eſſe ſummæ angulorum *l b d* & *l c d*. Cùmque *l b d* ſemis ſit ipſius *l t d*, & *l c d* ſemis ipſius *l y d*; erit ſanè ſumma ipſorum *l b d* & *l c d* = ſemi-ſummæ angulorum *l t d* & *l y d*, hoc eſt, differentia angulorum *b l c* & *b d c* = erit ſemi-differentiæ angulorum *t l y* & *t d y*, quorum prior eſt intervallum apparens duarum Obſervationum, poſterior autem, intervallum motûs medii. Quare, datâ horum intervallorum differentiâ, datur quoque hujus ſemis, nimir. differentia angulorum *b l c* & *b d c*. Sed *b l c* idem eſt cum *t l y* dato; Ergò datur quoque *b d c* angulus, ſub quo peripheria *b c* ſpectatur ex *d*.

Unde liquet, ex datis intervallis Obſervationum mediis & apparentibus, dari angulos, ſub quibus ex *d* ſpectantur Circuli *a b c* peripheriæ quotvis, interceptæ à lineis veri motûs. Ergò, per *Herigoni Theor. Plan.* l. 1. c. 3. Prop. 12. *Schol.* 1. totidem Circuli ſegmenta deſcribi poſſunt, capacia angulorum, ſub quibus iſti arcus conſpiciuntur ex *d*, quæ ſegmenta omnia ſe mutuò interſecabunt in *d*. Poſſunt igitur & hac Methodo inveniri Apogéa & Excentricitates Planetarum, delineatione Geometricâ, adhibitis Obſervationibus *quotvis*; nec difficilius eſt, Circulos ducere, quàm lineas rectas.

Sed ut demus id, quod verum eſt, Clariſſimi *Caſſini* delinationem Geometricam non-nihil expeditiorem eſſe; verendum eſt interim, ne, ſi ἀκρίβειαν Aſtronomis expetitam ſectemur, Diagrammata requirat enormis magnitudinis, adeóque operoſior evadat, quàm ipſe Calculus. Ad hunc autem accedentes, utramque Methodum æquipollere deprehendemus.

Adhibeamus enim ex Obſervationibus *Tychonicis* tres, quæ Dom. *Caſsini* Diagrammati quodammodo conſentiant; nim. Obſervationem A, cùm *An.* 1604, *Mart.* 28 *d.* 16 *h.* 23 *m.* *Mars* obſervatus fuit in ♎ 18 *g.* 37 *m.* 10 *s.* B, cum *An.* 1587, *Mart.* 6 *d.* 7 *h.* 23 *m.* idem Planeta viſus fuit in ♍ 20 *g.* 43 *m.* 0 *s.* Denique C, cùm *An.* 1600 *Jan.* 18 *d.* 14 *h.* 2 *m.* deprehenderetur in ♌ 8 *g.* 38 *m.* 0 *s.* Eſt igitur inter A & B intervallum apparens 22 *g.* 54 *m.* 10 *s.* & huic reſpondens medium 25 *g.* 58 *m.* 40 *s*; at inter B & C intervallum apparens 47 *g.* 5 *m.* 0 *s.* & medium 56 *g.* 21 *m.* 57 *s.* Itaque

Methode Caſſini, Fig. *II.*

1. In Triangulo D B H,
Dantur D B 10,00000
D B H 12|99
B D H 11|45
Quæritur B H 9,68106

2. In Triangulo DBG.
Dantur D B 10,00000
D B G 28|18
B D G 23|54
Quær. B G 9,70653

3. In Triangulo HBG.
Dantur B H 9,68106
B G 9,70653
H B G 41|17
Quær. B G H 64|95
Cujus Compl. GBI 25|05
Si auferas ex GBD 28|18
Reſtat IBD vel IBL 3|13

4. In Triangulo GB I.
Dantur B G 9,70653
G I B 90
G B I 25|05
Quær. B I 9,66363

5. In Triangulo I B L.
Dantur B I 9,66363
BL (ſemis τȣ̃ BD) 9,69897
IBL 3|13
Quær. BLI 32|31, An. vera, & L I, 8,67284, Excentricitas.

Methodo Herigoni, Fig. *V.*

1. In Triangulo *dbh*,
Dantur *db* 10,00000
adb externus 24|44
bhd 11|45
Quær. *bh* 10,31894

2. In Triangulo *dbg*.
Dantur *db* 10,00000
cdb externus 51|72
bgd 23|54
Quær. *bg* 10,29347

3. In Triangulo *hbg*,
Dantur *bh* 10,31894
bg 10,29347
hbg 41|17
Quær. *bhg* (vel *bhi*) 64|95 = *bsg*
Et *hib* = *sgb* = 90
Ergo *hbi* = *gbs* = 25|05
Ex *gbi* = *gbs* + *sbi* (= *hbg* — *hbi*) = 16|12
Aufer *dbh* = *hbi* — *dbi* = 12|99
Reſtat *gbs* + *sbi* — *hbi* + *dbi* = *sbd* (vel *dbl*) 3|13

4. In Triangulo *gbs*
Dantur *bg* 10,29347
bgs 90
gbs 25|05
Quær. *bs* 10,33637

5. In Triangulo *dbl*,
Dantur *bd* 10,00000
bl (ſemis τȣ̃ *bs*) 10,03534
dbl 3|13
Quærit. *bld* 32|31 Anom vera
Et *ld* 9,00926 Excentricitas.

Nimir. Ut Fig. *II.* B L 9,69897, ad L I, 8,67284;
Ita Fig. *V.* *bl* 10,03534, ad *ld* 9,00926.

	s.	g.	m.	ſec.
Ex loco apparenti ſecundæ Obſervationis	5	25	43	0
auferatur angulus Anomaliæ veræ B L I	1	2	18	36
Reſtat locus Apogéi	4	23	24	24

Erat autem reverâ ævo *Tychonis* Apogeon *Martis* in ♌ 28 $\frac{1}{2}$ *d.*, à quo deficit iſte locus, calculo inventus; ſolidis quinque gradibus. Porrò,
Ut B L 9,69897, ⎫ Ita 5,18290 Log-us 152369 diſtantiæ med. ♂tis,
ad L I 8,67284; ⎭ ad 4,15677 Log-um 14347 Excentricitatis ♂tis.

Eſt autum vera Excentric. ♂tis 14179, quam iſta, calculo inventa, excedit $\frac{168}{14179}$ particulis.

Cæterùm in ratiocinio ſecundùm utramque Methodum inſtituto notare licet non modò perpetuam Triangulorum ſimilitudinem, ſed & Epilogiſmi congruentiam; ne quis Apogéi & Excentricitatis ſic inventæ à vero diſcrepantiam cenſeat errori Calculi imputandam. Sed nec Obſervationum vitio contingit; quas in dubium vocare nil aliud foret, quàm principia in Aſtronomia negare. Itaque reſtat, ut Hypotheſin excutiamus.

Et *Ellipticæ* quidem Orbitæ Inventio ſine controverſia *Keplero* debetur; ſed quibus Accelerationis & Retardationis gradibus incedant Planetæ, definire, non minùs pertinet ad integrandam Hypotheſin, quàm ipſius Orbitæ determinatio. Quanquam autem ex Cl. *Caſſini* (vel Interpretis ejus) ſermone id nuſquam apparet; attamen ex Conſtructione Problematis, & ejus Analyſi, manifeſtum eſt, eum ſupponere, Planetam ex foco ſuperiori videri prorſus æquabili motu incedere. Fuit ſanè, cùm idem exiſtimaret *Keplerus*, quod ejus Scripta evolventibus liquere poteſt. Sed cum id Obſervationibus nequaquam congruere animadverteret, mutavit ſententiam, & lineam veri motûs Planetæ æqualibus temporibus æquales areas Ellipticas verrere profeſſus eſt: Punctum autem, ex quo Planeta exactè æquabili motu procedere videtur, nullum omninò extare in hoc Univerſo, niſi id libratile ſtatuere libeat. Nulli interim puncto propriùs æquabilem videri inceſſum Planetæ, quàm ipſi foco ſuperiori Ellipſeos. Neque inventus fuit hactenus, qui areas *Kepleri* phænomenis ſatisfacere poſſe negaret; ſed, cùm eas Calculò directò exhibere nec ipſe nec poſt eum quiſquam potuerit, cauſati ſunt nonnulli, *Keplerum*, nimis indulgentem cauſis *Phyſicis*, à *Geometria* diverſum abiiſſe; quaſi cauſæ phyſicæ repugnent Geometriæ, aut minus Geometricum ſit Problema, quod, nullâ injectâ phyſicarum cauſarum mentione, ſic proponitur: *Data area Trilinei, inter lineas abſidum, & veri motus, nec non peripheriam Ellipticam intercepti, invenire Angulum ad Solem.* Habent igitur à *Keplero* reſponſum, qui illi ἀγεωμετρίαν objiciunt; nim. *Eant ipſi & Schema ſolvant.*

Quamvis autem religio fuerit *Keplero*, ab Hypotheſi, quam *Naturalem* eſſe planè perſuaſum habebat, recedere; quidni liberum foret aliis periculum facere, num via quævis alia detur, inæqualitatem Planetarum primam directo Calculo inveſtigandi? Ideoque Vir Clariſſ. *Iſm. Bullialdus* aggreſſus eſt ratiocinio Geometrico indagare, quâ ſemitâ, & quibus intenſionis ac remiſſionis gradibus conveniret Planetas ferri, ut ab æquabili inceſsûs norma, Aſtronomis ante *Keplerum* aſſumptâ, ad eam, quam ſpectamus, Inæqualitatem perduceremur. Perennant Illuſtriſſimi viri monumenta, unde omnem hujus Inventi rationem haurire licet Aſtrophilis. Amplexus eandem Reverendiſs. *Seth. Wardus*, primùm oſtendit, paria facere cum linea æquabilis motûs circa alterum Ellipſeos umbilicum gyrata; deinde & Calculi directi methodo ornavit eâ, quam paulò antè recitavimus: Ita ut nil amplius deſiderari poſset, quàm ut *Urania* felicibus cæptis annueret. Cujus quidem nomine ſuſcipere auſus fuit Illuſtriſs. Comes *Paganus*, edito, *biennio poſt*, ejuſdem ferè tenoris Scripto, adeò veram eſſe Hypotheſin, ut deprehenſam circa Octantes diſcrepantiam, Aſtronomorum inſcitiæ tributam mallet. At Cl. *Bullialdus*, audiendam potiùs ipſam Aſtronomiam ratus, Obſervatorum ore loquentem, ſecundis curis, adhibita prioribus Inventis limitatione quadam, diſcrepantiam illam exterminavit. Unde porrò intelligitur, Hypotheſin illam, cui Cl. *Caſſinus* inveſtigationem Apogeorum & Excentricitatum ſuperſtruit, tantundem ferè deficere à vero, quantum Cl. *Bullialdi* limitatio pollet, atque ab illo defectu pullulare eum quem ſuprà notavimus, Calculi à Cœlo diſſenſum.

Tantùm vero abeſt, ut de Eximii Viri Inventione vel minimum delibatum velim, ut quicquid hujus lucubratiunculæ non hauſi ex Reverendiſſ. *Wardo*, vel *Herigono*, id omne Ipſi libentiſſimè acceptum referam, qui anſam nobis præbuit hæc altius conſiderandi. Nec dubitamus, quin omnia iſta multò uberiùs ac luculentiùs in promiſſo *Tractatu* expoſita propediem reperturi ſimus, cujus Editionem maturam, pro eo qno flagramus diviniſſimæ Scientiæ amore, perquàm avidè exſpectamus.

An Account of Three Books.

I. Eſperienze *intorno alla* Generatione Degl' Inſetti, *fatte da* Franciſco Redi, *Academico della Cruſca. In* Firenze, *A.* 1668. *in* 4o.

THe Learned and Ingenious Author of this Book, lately come to the Publiſhers hands, though not yet (which is much diſliked by the curious) into our Stationers Shops, doth with much induſtry undertake therein to evince, that there is no ſuch thing as *Æquivocal* Generation, but that every Animal is generated by the ſeed of another Animal, (its parent,) or, at leaſt, from ſome Living and un-corrupted Plant, as out of Oak-Apples, and ſeveral Protuberances and Excreſcencies of Vegetables.

Firſt then, in the aſſerting of the *Univerſal* and true Generation of Inſects by a peculiar and paternal Seed, the Author poſitively affirms, that he could never find, by all the Experiments and Obſervations, he ever made (of which he relateth a great number, by himſelf made upon all ſorts of Animals) that ever any Inſects were bred from Fleſh, or Fiſh, or *putrified* Plants, or any other Bodies, but ſuch, as Flies had acceſs unto, and ſcatter'd their ſeed upon; he having taken extraordinary care and pains to obſerve, that alwayes on the Fleſh, before it did verminate, there ſate Flies of the ſelf ſame kind with thoſe, that were afterwards produc'd thence; and again, that no Worms would ever come from any Fleſh in Veſſels well cover'd, and defended from the acceſs of Flies; ſo that to him there is no generation of Inſects from any dead Animals, but ſuch as have been fly-blown.

And leaſt it ſhould be objected, that the reaſon, why in veſſels exactly clos'd, no Inſect breeds, is the want of Air, neceſſary to all Generation, He hath carefully covered ſeveral veſſels with very fine Naples-vaile, for the Air to enter, though Flyes could not; but that no worms at all were bred there, notwithſtanding that many Flyes ſwarmed about them, invited by the ſmel of the Fleſh incloſed therein.

Secondly, to make out the other part of his Poſition, *viz.* That thoſe Animals that are not bred by the ſeed of other Animals, are produced from ſome live Plant, or its

Excreſcence; This Author eſteems it not abſurd to affirme, that that *Anima* or Power, which is able to produce Flowers and Fruits in living Plants, may be alike capable to breed Worms in them; ſince that Soul is ſo powerful, as to cauſe Plants to feed, to grow and to produce ſeed, as it doth in Animals. For confirmation of which, he obſerveth, that both the generation of Worms in Vegetables is always and conſtantly the ſame (not at all caſual,) and that all *Galls* grow conſtantly in one determinat part of the branches, and always in the new branches; as alſo, that thoſe little Galls, which grow on the leaves of the Oak Holm *&c.* do all grow conſtantly on the fibres or ſtrings of thoſe leaves, not one of them being ſeen to grow on the ſmooth part betwixt two ſtrings: Farther, that there are found many leaves of other trees, on which grow Veſicles, or ſmall baggs, or ſome wrinkled or ſwell'd places, full of worms, ſpringing forth with thoſe leaves. Beſides, that there is not one Gall, but it hath its proper worm; and that each ſort of galls hath its peculiar and determinate race of worms and flyes, which never vary: Where he takes notice of the ſingular Art of Nature both in forming the Egg, which is found in the center of Galls, and in preparing its place therin, furniſhing it with many filaments, that paſs from the Gall-aple to the Egg, as ſo many veins and Arteries, ſerving for the formation of the Egg and Worm, and for the nouriſhment requiſite thereto. To which he adds this Obſervation, that, there being certain ſorts of Galls, which breed more worms at a time than one, Nature hath carefully provided and diſtinguiſht places for them, as ſhe doth in thoſe Animals, that are multiparous.

Having eſtabliſht this ground againſt *Æquivocal* generation, he proceeds to particulars, and refutes the opinion of thoſe, that will have Bees to be bred of the putrifyed fleſh of Bullocks; VVaſps, of Aſſes or Mules-fleſh; Drones, of Horſes; Scorpions, of buried Crafiſhes, or the herb *Baſilica*, or dead *Scorpions*: Toads, of Ducks buried in Dung; Mites, of *Cheeſe*, affirming, that none of theſe Inſects have any ſuch origin mentioned, but that all thoſe ſubſtances have been firſt blown upon by ſome Flye or other.

He interſperſeth through the whole Book many curious and conſiderable Obſervations, relating to this Subject: As, that ſome Flyes are viviparous, others oviparous only, yet not denying, but that the ſame Flyes may ſometimes breed live worms, ſometimes lay eggs, according to the more or leſs heat of the ſeaſon. 2. That Humane bodies breed worms, but not immediately, but by Inſects blowing on them. 3. That Fruit and Herbs, crude or boyled, kept cloſed up, breed no Vermin, but in an open place, do breed ſome. 4. That there are no Animals partly animated, partly yet earthy, nor Animals half animated, and half wood. 5. That worms breed in the Livers of Mutton, and the Heads of Staggs, he having ſeen divers of them in both theſe kinds of Animals, and eſteeming, that the ſoul of the ſuperiour animal was able to breed thoſe inferiour animals. 6. That Lice are bred of Eggs or nits, laid by their Femal-parent; he having diſcerned by a Microſcope ſome nits yet pregnant with young ones, others, emptied of them. 7. That all living Creatures are ſubject to lice or ſome ſuch kind of Vermine; the *Aſſe* not being exempted from them, as *Ariſtotle*, and upon his authority, *Pliny*, *Mouffet* &c. would have it: And that all ſorts of fowle (except *Oſtridges*, in which he never could meet with any Vermin in any ſeaſon,) and fiſh, have each ſort their peculiar lice: Of which he hath repreſented divers of ſeveral ſorts.

N B. The Author promiſes in this Treatiſe a very particular Hiſtory of the various Fruits and Animals, that are generated of Oaks and other Trees.

II. *Pharmacopoeia Regia, ſive Diſpenſatorium Novum locupletatum & abſolutum, cum annexa* Mantiſſa *Spagyrica, & gemino Diſcurſu Apologetico contra* Ott. Tachenium, & Franc. Vernis. *Auth* Joh. Zwelfer. M. D. A. 1668. *in folio.*

THe Author of this Volume, after he had publiſht to the World his *Animadverſions* upon the *Pharmacopoeia Auguſtana*, and after that, a *Pharmacopoeia Regia*, and then, an *Appendix* ſuperadded to both, pretends now in this vaſt Work to deliver ſomething compleat of this kind, following the Experiments and Operations made in his Laboratory, by which he affirms to have given us the Compoſitions and Preparations of the choiſeſt Medicaments, performed by a genuin and accurat Method, according to the

19. Claſſes of the *Auguſtan Diſpenſatory*, and directing all to the principal parts of the humane Body, and the particular Caſes of Patients, ſo that in almoſt each *Claſſis* there may be found (he Judgeth) precious remedies deſcribed for every ſickneſs, un-common ones, and confirmed by Natural and Medical Reaſons, and Experience itſelf. Where he ingenuouſly cautions his Reader, above all things to examine, by whom Medicins are prepared, and particularly inſtanceth in a Preparation of Antimonium Diaphoreticum, which, though himſelf had uſed it, when duely and by himſelf prepared, with very great ſucceſs againſt the Plague, yet had found almoſt fatal to himſelf; upon occaſion taking it, when prepared by a Pſeudo-Chymiſt.

In the annexed *Mantiſſa* he deſcribes the Medicins, that may be made of all ſorts of Metals; as alſo of Antimony, Vitriol, Sulphur, Niter, and Tartar; among all which (to note that upon the by) he declareth the vertue of *Aurum fulminans* for an excellent *Diaphoretick*; and teacheth, how its fulminating force may be taken away, *viz.* by a little Spirit of Salt powred on it, or by ſome diſtilled Vinegar boyled with it.

Farther, our Author in his *Defence* againſt *Tachenius* (who with ſome ſharpneſs had attacked all his former Writings) makes it his buſineſs, to refute *Tachenius* his way of *Fixing the Volatil Salt of Vipers*, which, it ſeems, he had formerly communicated to him when they friendly converſed together, but, upon tryal, proved falſe: Where our Author takes occaſion to evince it not to be true, that Animals contain none but Volatile Salt, and that Vegetables likewiſe have not a grain of fixt Salt, except it be produced therein by the Fire; both which *Tachenius* ſeems to have aſſerted. To which he adds an examination of the Doctrine of Salts, delivered by the ſaid *Tachenius* in his *Hippocrates Chymicus*, not at all approving, that he confounds the Lixiviats and Alcalyes with the Salts of Minerals and Animals, in that he gives to theſe two latter kinds of Salts one general name of *Alcaly's*: Where many things occur, belonging to the making of Soap, Glaſs, Verdegreaſe; as alſo to the Liquor diſtilled out of *Calx viva*, to Fulminating Gold, the Melting of Metals, the Salt of Tartar, the Generation of the Stone in Animals, the Alcalys and Reſuſcitation of Vegetables; the Helmontian *Ludus*, &c.

Moreover, this Author vindicates himſelf againſt the Notes of one *Franc. Verni* of *Montpelier*, written upon the *Pharmacopoeia Bricii Bauderonii*; publiſht in French A. 1662. at *Lyons*, in 4°. in which Notes the ſaid *Verny* excepts againſt our Author concerning the Preparation of the *Compounded Acid Syrup of Meſue*, and the *Confection of Alkermes*.

In this Work is alſo contained the Third and Enlarged Edition of the Authors *Animadverſions* upon the *Pharmacopoeia Auguſtana*, and its *Mantiſſa*; wherein, by a genuine and dextrous Method, the Preparations of Simple and Compounded Medicins are ſo delivered, and the Errors of the Ancients in ſuch a manner detected, that from thence, by preſerving and exalting the Vertues of the Simple Medicaments, they ſhall become much fitter means in the Hands of Phyſitians, ſuddenly, ſafely and pleaſantly to remove the diſtempers and Maladies of Humane Bodies.

To all which is alſo annexed his *Spagyrick Appendix*, wherein, what may ſeem in thoſe Animadverſions to be ſomewhat obſcure and imperfect, is pretended to be ſo much farther explained and perfected that it may not only render them farr more clear, but alſo enrich them with divers uncommon Conſiderations and Remedies: Where the *Reader* will meet, among many conſiderable Obſervations, a very neceſſary Caution concerning the *Oriental Bezoar*, of which the Author notes, there muſt needs be innumerable ſophiſticated ones, conſidering the multitude of them, pretended to be true ones, ſeen every where, in all parts and places of the World, whereas yet the Creature, whence 'tis taken, being a Savage Animal, like a kid, is not to be had but by Hunting, and that but in one corner of the *Eaſt-Indies*: Which Conſideration induces our Author to conclude, that moſt of thoſe Stones are factitious, prepared perhaps out of Magiſteries of Alexipharmical Plants, as Scordium, Rue and the like; which may alſo be of good uſe in cauſing ſweat and expelling poyſon.

III. *Affectionum quæ dicuntur Hyſtericæ & Hypochondriacæ Pathologia Spaſmodica Vindicata, contra Reſponſion. Epiſtol.* Nathanaelis Highmori *M. D. Cui acceſſere Exercitat. Medico-phyſicæ duæ,* 1. *De Sanguinis Accenſione.* 2. *De Motu Muſculari, Auth.* Tho. Willis *M. D. Nat. Philoſ. Prof.* Oxon, *nec non Med. Coll.* Londini *&* Soc. Regiæ *Sodalis.* Londini *apud* Jac. Alleſtry *In* 4°.

THe Learned Author of this Book makes it his chief buſineſs therein, to vindicate his Doctrine, which maketh the two Affections, expreſſed in the *Title*, to belong to the *Brain* and the *Nerves*, from the Arguments alledged by the other Learned Phyſitian Dr *Highmore*, who makes the one to be a diſtemper of the Bloud and Lungs, and the other of the Stomach. In the doing of which, our Author *firſt* undertakes to ſhew, by ſeveral conſiderable Arguments, that the affections, called *Hyſterical*, cannot proceed from the Lungs ſtuffed up to a great degree of ſtiffneſs with flatulent Bloud; ſeconding them by ſome Hiſtories and Obſervations, which ſeem very pertinent to his purpoſe: Which done, he proceeds to remove the difficulties and Objections, alledged by Dr *Highmore* in his Epiſtle, formerly printed, and taken notice of in N. 54. of theſe Tranſactions.

Secondly, he endeavors to evince, that the *Hypochondriack* paſſion is wrongfully aſcribed to the *Stomach*. Where he taketh occaſion, *both* to deny to the *Spleen* the office of Warming the Stomach, *and* to aſſert the Fermentative function of the ſame: Teaching withal, that the Acidity is not produced in the ſtomach alone, nor thence only communicated to the Bloud and other humors; and that it proceeds from the fluor of the Salt, and that that Salt is one of the Elements of Natural things; which latter he attempts to make out by Experiments againſt the Objections of his Adverſary.

To this Vindication are annext two *Exercitations*, whereof the *Firſt* is concerned in proving the *Accenſion of the Bloud*: Where the Author undertakes to ſhew, that the Bloud being animate, that Animation or Life depends from its being kindled, foraſmuch as the proper affections of Fire and Flame belong to the Life of the Bloud; which is here deduced at large; although it be withal acknowledged, that this Vital Flame doth not, as the common Flame, appear to view, in regard that its Form is ſubordinate to another ſuperior *Form*, *viz.* the Corporeal Soul of the Animal.

The *ſecond* Diſcourſe treateth of the *Muſcular Motion*, where, having declared, that Dr *Steno* hath been the firſt that hath delivered aright the Structure of Muſcles, and that the Figures deſcribed by him are viſible in them; and alſo made out the motions of their Fibers by divers Anatomical Experiments; beſides many other conſiderable particulars: He aſſerts, that the Motion of Muſcles depends from a conſtant Influx, both of the Bloud and the Animal ſpirits; and that the latter alone, without being aſſociated by the former, cannot perform that moving function; maintaining, that as the Spirits (or Springy particles) in the contraction of a Muſcle ruſh out of the Tendons into the Fleſhy parts of it, and in the relaxation, skip back from theſe into thoſe, ſo thoſe Spirits, lying quiet within the Tendons, do ſwell the Fleſhy fibres by conflicting and ſtrugling there with the particles of Bloud. To which he adds the manner, how the Inſtinct (as he pleaſeth to call it) of performing or ſtopping the Muſcular Motion, is imprinted by the Nerves in the Muſcles: Subjoyning alſo divers important particulars concerning two ſorts of Spaſmes or Convulſions proceeding from the Muſcles, with an illuſtration of the ſame by a very remarkable caſe. All which he concludeth with ſolving the Objections, to which this his Doctrine of the Muſcles may be lyable, and annexing ſome Figures, very lively repreting ſome Muſcles, together with an Explication of the ſame.

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PHILOSOPHICAL TRANSACTIONS.

April 25. 1670.

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AN EXTRACT

Of a Letter written by Monſieur de Martel *of* Montauban *to the Publiſher, concerning a way for the Prolongation of Humane Life, together with ſome Obſervations made in the Southern parts of* France; *Engliſh'd as follows.*

SIR, Since you'll have me ſay ſomething to you of my preſent Engagements and Studies, I ſhall tell you, that I retain ſtill my former inclination to Philoſophy, and to ſearch after

Truths, either uſeful to Humane Life, or improving the underſtanding of Man: But by reaſon of many troubleſom Avocations, I cannot apply my ſelf to it but by Fits and Intervals; and I muſt ſtay for a better time, and more favourable opportunities, to comply with my genius. All I can do at preſent, is, to make Reflexions upon ſome Experiments, in the doing of which I find I am more particularly engaged in thoſe, which regard our health; concerning which, I employ much of that time I can redeem from the buſineſs of my Voyages; wherein, when I am alone, I frequently entertain my ſelf with *that* Subject. And in reference to it, I ſhall now declare unto you, under the favour of Philoſophical liberty, and your friendſhip, a thought of mine, much poſſeſſing my mind, but perhaps one of the moſt extravagant in the judgement of the Vulgar.

After I had often reflected upon the general cauſes of Diſeaſes that lead to Death, I mean thoſe of the Debilitation of Nature's ſtrength in the courſe of mans life, until its utter extinction, and of the cauſes of a meerly natural Death, by the failure of that ſtrength in an extreme decrepit Age, without the concurrence of any exceſs or external cauſe; I have entertain'd ſome conjecture, that if we were more intelligent in this matter, than we are, we might procure for our ſelves an Age of continual Youth; ſetting aſide the ſeveral Accidents of Divine Providence, and meerly conſidering the forces of Nature, not only not hinder'd, but alſo aſſiſted as much as may be.

A certain Philoſopher hath formerly been upon the ſame thing, and *Cardan* affirms, that being young, this fancy rolled in his head; and the *Chineſe* ſearch for it with an extreme induſtry; but neither thoſe, that have recorded that of the ancient Philoſopher, nor *Cardan*, have ſaid any thing of the ground of their notion, nor of the way which they thought was to be obſerved for attaining the end thereof. *Ne videar inſanire ſine ratione*, I will tell you, what it is, I have grounded my conjecture upon.

Searching for the true cauſes of old Age, and of natural Death, I was not ſatisfied with that extinction of natural heat and deſiccation of the Radical humour, aſſign'd to be the cauſe thereof, nor with the cauſes of this extinction and deſiccation, that are commonly alledged; it being ſuppoſed, that this hot and moiſt principle of Life, in its own nature diſſipable in the courſe of Life, not being perfectly repaired by food, is conſiderably diminiſht, which brings old Age, and is at laſt quite conſumed, which cauſeth natural Death; where Authors make a great difference between the *Seminal* heat and moiſture, and that which comes from Aliments; ſo that, *ſay they*, the former cannot be repair'd by the latter, as being heterogeneous. Which to me ſeems not to be true; for, doth not this *Seminal* heat and moiſture originally proceed from what is ſuperfluous of the third Concoction of the Aliments? It is therefore of the ſame nature; and nothing hinders, but what is diſſipated thereof may be perfectly reſtor'd by good nouriſhment, well prepar'd, and taken ſeaſonably and in due quantity. Whence it may be juſtly concluded, that the defect of repairing this principle of Life comes not from its nature, not reparable this way, but from ſomething elſe.

The illuſtrious *Bacon*, finding the weakneſs of this ſuppoſition, did conceive, that this fault came from the inequal reparation of the liquid or ſoft, and the dry or more ſolid parts, which jointly ſerve to maintain and repair themſelves; whence it comes to paſs, that the moſt eaſie to repair, and the moſt neceſſary for Life, as the Blood, ceaſe at laſt to be ſufficiently repair'd by the defect of the others, which are not repair'd at all.

Sanctorius, being almoſt of the ſame ſentiment, holds, that natural Death happens, becauſe the Fibres do ſo dry up, that they can no more be renew'd; he making the maintenance of life to depend from the renovation of the parts. Which doth not ſatisfie me neither, becauſe even the Bones themſelves, which are the hardeſt parts, are capable of renovation in old Age; in regard that old Oxen, which we often eat, have, at certain times (I ſay not of the Moon, according to the common opinion) their Bones of the ſame place altogether dry and marrow-leſs, and at other times bedewed with a ſubſtance of the nature of marrow, wherewith they are then fill'd, which enlargeth their pores as of a fine Spunge, and ſoftens them; which then eſpecially comes to paſs, after they have fed upon good paſture in the Spring. We muſt therefore inquire into other more true cauſes of old Age and Death, which to me ſeem to be the following.

I ſuppoſe, that the Blood is the principle of life, as far as 'tis vital, that is, in motion by the hot particles contained therein; ſo that thoſe, who expire by Age, do not dye for being deſtitute of blood, which is found abundant and laudable enough in their veſſels, and which hath been ſufficiently repaired till then; but becauſe it ceaſeth to be vital, by reaſon of the too eaſie diſſipation of the igneous particles, which make it ſuch: Which, in my opinion, comes to paſs, as it doth in Wine, which evaporates and loſeth its ſtrength by the fault of the Veſſel, which by ſome opening or other gives paſſage to what gives vertue to the Wine. The Tunicles and Membranes of the Veins and Arteries which incloſe the blood, wear in time away and wax thin, and their Texture gives, and breaks in ſeveral places, at which apertures the igneous particles abandon the blood: As in Stuffs and Cloth (whoſe woof is in a manner like that of the Tunicles) the Threds by wearing do looſen and break, inſomuch that many holes are made in it as in a Sieve. So that, if we had the Art to reinforce and to ſtrengthen anew thoſe Coats and Membranes, that they might not let ſlip what maketh the blood vital, the life would be preſerved perpetually. For a proof of which, this may ſerve for the preſent, that the life of many dying perſons is maintain'd, for ſome time, by making them ſwallow ſome hot and ſpirituous liquor, as ſpirit of Wine, or ſome Eſſence, by which the blood is fortified and quickned for ſome moments: But as this reinforcement of life, conveyed to the heart, and running into the Veins, ſoon ſlips out, ſo alſo this new vigor paſſeth away quickly.

As there is no reaſon to deſpair of finding out ſuch Medicins, or Aliments, as are proper to ſtrengthen the Coats and Membranes of the Veſſels, ſo as they may at all times retain the fiery and ſpirituous corpuſcles of the blood, as well as in the time of Youth; We may alſo hope to be enabled to maintain the blood in a condition alwayes to furniſh alike, as in our vigorous Age, for all the functions of life: The Engine of our body being not unlike to a Chymiſts Furnace, which at firſt well retaining the heat, is very proper for the operations of Art; but at laſt, chinks and crevices being made therein, it ceaſes to be ſo, the heat getting away through them, what fire ſoever you kindle therein.

I ſhall ſay no more of it, the Sequel of what I have ſaid going very far, if it be true. In the mean time, if you think it not contemptible, I ſhall ſend you all what I have meditated upon it, at large, and in the form of a juſt Volume.

Although this Diſcourſe exceeds already the bounds of a Letter, yet to ſatisfie your curioſity, I ſhall add ſome few Obſervations, I have met with in theſe parts.

Firſt, Returning from *Montpeliers*, I went purpoſely to *Frontignac* in the laſt Vintage, to give you an accompt of the manner, how they make their *Muſcadin-Wine.* They let the Grapes grow half dry upon the Vine, and as ſoon as they are gather'd, they tread and preſs them immediately, and Tun up the liquor, without letting it ſtand and work in the Fat, the Lee cauſing its goodneſs. Thus is made the true genuine Muſcadine, without mixing any other ſort of Grape with it. Lately a certain perſon thought fit to paſs White-Wine of another kind upon the mark or husks (which are wont to be caſt away) of the Muſcadine Grapes, and hath made in this manner an excellent Wine, which hath the taſte of Muſcadine, and is more pleaſing to ſome, nor is ſo heady, as the franc or true Muſcadine.

Secondly, Upon the way of *Beziers* to *Narbonne*, in a place pretty large, raiſed by eſtimation above the level of the Sea, (which is two Leagues diſtant from it) about 15 or 16 fathoms, I ſaw Rocks, which incloſed a good number of big Oyſters petrify'd: And upon the ſame way above the place, which is call'd *Nice*, at the higheſt place of the deſcent, very cragged, where the Rock is cut to make a paſſage, is ſeen a Bed, two foot large, of many Cockle-ſhells petrify'd, heap'd up, as ordinarily they are on the Sea-ſhoar; which notes ſufficiently, that the Sea formerly cover'd this place, according to what *Ariſtotle* ſomewhere ſaith, *Ubi nunc eſt Arida, olim Mare fuit.*

Thirdly, We met lately with a Body, which being opened, the Liquor, which is contain'd in the *Pericardium*, or the Bag of the Heart, was found congealed into a conſiſtence fit to be cut with a Knife, and two ſquare fingers thick about the Heart. I know not, whether this Obſervation be rare: But it is time to conclude with the aſſurance of my being, *&c.*

At *Montauban*,
Dec. 4. 1669.

AN OBSERVATION

Of M. Adrian Azout, *a French Philoſopher, made in* Rome *(where he now is) about the beginning of this Year* 1670. *concerning the Declination of the Magnet: Out of an Italian printed Paper, Engliſh'd by the Publiſher, as follows.*

THe *Declination* of the *Load-ſtone* hath for many Years been obſerv'd not to continue alwayes the ſame in the ſame places; and the *Variation* to be ſuch, that it can be no longer imputed to any defect in the Obſervations, as it was believed at firſt, when it was not very great: It hath been noted, ſome Years ſince, that the Magnetick Needle, which almoſt everywhere had declin'd *Eaſtward* to 8, 10, and 12 degrees (as may be ſeen in *P. Kircher*, and *P. Riccioli*) after its diminiſhing little by little as far as to the *Meridian*, began to decline *Weſt-ward*.

M. *Adrian Auzout*, a great Searcher of the more conſiderable Effects of Nature, hath made here in *Rome* the following Obſervation about the Declination of the Load-ſtone, on many Meridian lines drawn as exactly as poſſibly he could (in a place, where he hath not all the conveniency for this performance) with a Needle, three quarters of a Palm * long; and on all the lines it was ſeen to decline ſomewhat more than *two* degrees *Weſt-ward*, and on ſome, near *two* degrees and an *half*.

* *This is about ſix Inches.*

And that the Obſervation might be the ſurer, he drew parallel Lines in divers places, to ſee whether there were any Iron or Bricks near the Marble, on which he had deſcribed the Lines, that might have ſome influence upon the Needle;

dle; but he alwayes found the ſame quantity of Declination Weſt-ward.

But by the Obſervations, here made formerly, it appears, that the Needle hath declin'd *Eaſt-ward* to 8 degrees, and hath afterwards been diminiſhing, until 'tis come to the other part, where we find it at preſent. The Obſervations, that may be made hereafter, will ſhew how far the Declination will advance towards the Weſt, and what will happen after its greateſt elongation; it not being probable, it ſhould encreaſe alwayes, and make a whole turn.

It ſeems not, that this difference of *ten* degrees and more can be attributed to the change of the Pole of the Earth, as ſome eſteem'd, perhaps before they knew it was ſo great; nor (as others would have it) to the Magnet, or to the Iron, that are found in certain places, becauſe there is but little Load-ſtone; and Mr. *Auzout* affirms, that the Mines, which he hath ſeen, make no impreſſion at all on the Needle. So that 'tis difficult to hit the true cauſe of ſuch a Variation: Yet however, if the direction of the Magnet, and of the Needle touched by it, depends from the flux of a certain matter, paſſing through the whole Earth, or the exterior parts of it, ſtrait along the *Axis*; it may be ſaid, that it proceeds from changes made in the ſaid flux, which, ſuppoſing the inequalities of the Earth, and the alterations continually made therein, as well artificial, by excavations and ſuch like other works, as Natural, by corroſions cauſed by fire and water, or by the generation of Metta's and Stones (beſides the various changes, we cannot think of by reaſon of the little knowledge we have of ſo vaſt a Body as the Earth) cannot but in progreſs of time change its ſcituation. To illuſtrate this with an Example taken from Rivers; They, although they were running ſtrait, cannot remain long without winding, and changing their courſe, if it happen, that the ground, over which they run, be unequal, or of a different nature. So 'tis probable, that the inequalities of the Earth may in time occaſion ſome bending in the current of this Magnetick matter, and make it change its bed and channel: Whence it comes to paſs, that the Needle changeth its direction according as the Current changeth, which directs it. And if you will conſider the variety of motions, ſeen in Rivers becauſe of the higher or lower grounds, which are found in their Beds, and cauſe various windings and whirlings in them, poſſibly a reaſon may be rendred of the many differences, obſerv'd in the Declination of the Needle (*e. g.* why in ſome parts the Needle varies much in a little time; why, in others, it is alwayes turning without any ſtay, as ſome ſay they have obſerv'd; why the greater alterations are met with at the entring into, and going out of Iſlands?) and of many other things, we for brevities ſake paſs by; as we alſo omit to deduce from it divers particulars relating to Navigation.

Which if it ſhould be ſo, there would be no hopes of finding a regular Hypotheſis for that change, foraſmuch as it would depend from cauſes that have no regularity at all in them, as moſt of the mutations of Nature are. You may only take notice, that if there be a proportion between the force of the ſaid Current, and the Earth, *that* may be able by changing its Bed, remove *this* from its proper ſite: Which would produce an alteration in the height of the Pole, as ſome think they have obſerv'd, if *that* may not be aſcribed to a defect in the Obſervations, of which we may be rendred certain, when more exact ones ſhall have been made. And ſo, whereas others would impute the various Declination of the Magnet to the change of the Pole, we ſhould be obliged to attribute the change of the Pole to the various Declination of the Magnet.

From this Obſervation, which was thought fit to be publiſht here, Mathematicians are invited from time to time to make the like in their Countries, to ſee, whether in this change there be any regularity. If it had been obſerv'd every Year, we ſhould already know the progreſs thereof, and ſee, whether there were an Uniformity, and in what time the Needle did exactly reſpect the Pole. Wherefore it were very deſirable, that for the future, they would uſe greater care and diligence, in making moſt exact Meridians, as well for their own Obſervations, as for the conveniency of thoſe, who in their Travels ſhall have the curioſity of obſerving with the Needle it ſelf, as M. *Auzout* deſigned to do in the Cities where he paſs'd, if he had found Meridians there, or ſuch as had been unſuſpected of the proximity of Iron.

It were well to obſerve, Whether the Declination, which almoſt through all *Europe* hath been *Eaſtward*, be now everywhere *Weſtward?* As alſo, Whether in *America*, where the Declination was almoſt every where *Weſtward*, it be increaſed or no proportionally; and ſo of other parts of the World? Noting withall the Year; which is not at all minded by ſome, who relate the Obſervations, without aſſigning the Year, in regard it will be very uſeful, to know the preſent Declination; and it might be put in Journals, for Navigation, and for the uſe of Magnetick Quadrants.

So far this Relation: In purſuance of which, Order hath been given by the Royal Society, *that preciſe* Meridians *be made in ſeveral places of* England; *for obſerving the preſent Declination of the Needle from them, here in* London, *and other Cities of this Kingdom: And that even thoſe* Meridians, *that were made very exactly many Years ago, be examin'd by a careful deſcribing of new ones, to ſee whether they ſtill hold true, in regard of the ſuſpected alterations in Nature.*

If any ſhall inquire after the Manner *of finding the Variation of the Needle, he will find ſeveral wayes of doing it accurately, both by Sea and Land, in* Numb. 24. *of theſe Tracts; where alſo the great uſefulneſs of making exact Obſervations of this kind, is taken notice of, both for the diſcovery of the true Cauſe of the Magnet*'s Verticity, *and for the finding the* Longitude *at Sea.*

An Extract of an Italian Letter

Written from Venice *by Signor* Jacomo Grandi, *to an Acquaintance of his in* London, *concerning ſome Anatomical Obſervations, and two odd Births: Engliſh'd by the Publiſher, as follows.*

HAving been honour'd here with the place of Publick Anatomiſt of *Venice*, though I have given as yet but a very ſlender accompt of my performances, in compariſon of the illuſtrious example of *Mundinus*, *Veſlingius*, *Molineta*, *&c.* yet I ſhall acquaint you with ſome particulars that have occurred to me. In my Anatomical Diſſections of the firſt Year, I met with nothing curious, but the *Virſungian* Channel, manifeſtly inſerting it ſelf in the Spleen, and admitting a Silver-ſtiletto; which I had never obſerv'd in any Corps: And then, a Liver divided into five Lobes, together with a Spleen of the figure of a Saw, of extraordinary bigneſs. Laſt year, one drowned of about 35 years of age, had the lacteous veſſels ſo apparent and ſo big, that having ſhewn them how they lay in the body, I ſhew'd them yet the day after, in the Meſentery taken out and diſplay'd upon a Table.

Beſides, I lighted upon two odd Births; one was of Twin-Females, very handſom, but ſo faſtn'd together by the breaſt, that there was not diſcern'd but one only Trunk of the body; which having their Chin united together, ſeem'd to kiſs one another. I could not diſſect them as I would, becauſe they were deliver'd to me to embalm, and the indigent Father of them, who look'd for gain, would not let me have them but for a great Sum of money. Wherefore, not to ſpoil them for the purpoſe deſign'd, having only open'd them upwards from the Navel, which was common to them both, I took out the Inteſtins, the Stomack, the Heart, the Lungs. There was but one Heart, though greater and rounder than ordinary, ſo that Nature ſeem'd to have united the matter of two into one. They had two Lungs, and one Stomack, the *Pylorus* of which did ſtrangely branch it ſelf into two ranks in the Bowels. There was but one Liver, but big; for the reſt, there were two Spleens, four Kidneys, two Wombs, full of a white matter, like a concreted *ſemen:* two *Vulva*'s, with their diſtinct *Hymens*. In ſhort, they were ſo well made in all the other Members, that the Painter, who was employ'd to draw them, affirm'd, That if they were done in Ivory, he would have paid any money for them.

The other Monſter was a Boy, terrible to behold, born with his Breaſt open, the Bowels out of the Belly, the Leggs diſtorted, the Bladder in the place of the Fundament; in the Genitals, beſides that the *Teſticuli* were cloſe to the Kidneys, there was nothing but a membranous expanſion, wherein the Spermatick veſſels were loſt. Signor *Steno*, who honour'd me with his viſit, ſaw the adminiſtration of it, which I had before made in the preſence of many Noblemen and Phyſitians at my houſe.

VENICE,

Januar. 25.

1670.

Some Directions and Inquiries with their Anſwers,

Concerning the Mines, Minerals, Baths, &c. of Hungary, Tranſylvania, Auſtria, *and other Countries neighbouring to thoſe.*

THe *Directions and Inquiries, as they were, ſome time ſince, recommended by the Publiſher to the care of the Ingenious and Learn'd Dr.* Edward Brown (*Son to that deſervedly famous Phyſitian Dr.* Thomas Brown, *and Fellow of the* Royal Society) *travelling in* Germany, Hungary, Turky, &c; *are theſe.*

To inquire in *Hungary*, *Tranſylvania*, *Auſtria*, and the other Countries thereabout, what is obſervable there, as to Minerals, Springs, Baths, Earths, Quarries, Metals; eſpecially the kinds, qualities, and vertues of Mineral waters? Whether there be any medicated Earths? And what Coals, Salt-Mines, or Salt-Springs, Allom, Vitriol, Sulphur, and Antimony, thoſe parts afford?

To inquire particularly, and to procure ſome of all the ſeveral ſorts of Antimony, and Antimony-Ore, to be found in *Hungary*.

To procure ſome of the beſt *Hungarian* Vitriol, the *Cinnabaris nativa*; as alſo of the true Gold and Silver-Earth or Ore, ſaid to be found at *Cranach* in *Hungary*.

To inquire after, and ſend over ſome of that kind of Vitriol, which by credible perſons is affirmed to be found chryſtallized in *Tranſylvania*.

To get a particular accompt of the Salt-Pits in *Tranſylvania*, which are ſaid to yield two ſorts of perfect Salt, the one being a *Sal Gemmæ*, the other, a common *Table-Salt*. To obſerve, how deep theſe Salt-Mines lie from the ſurface of the ground? How deep they have been digg'd hitherto? What damps are met with in them? *&c.*

To inquire after the veins of Gold and Quick-ſilver at *Cremnitz* in *Hungary*; and after the vein of Silver at *Schemnitz* in the ſame Countrey: And to ſend ſome of the beſt Ores of them all.

Whether in all the Mines of Gold, Silver, Copper, Iron, Lead, in *Hungary*, and the adjacent Countries, and particularly about *Newhauſel*, be everywhere found Quickſilver and Sulphur?

Whether it be true, that in the Copper-Mines of that place, which is call'd *Herrn-ground*, be found no Quick-ſilver at all?

Whether it be ſo, that in ſome parts of *Upper Hungary*, the Ores of Copper, Iron, Lead, be ſometimes ſo commixt, that there is often found in the upper part matter of Iron, in the midſt, of Copper, and in the lowermoſt, of Lead? And that in other places, Copperous fluors are mixt with Leaden ones?

Whether the Relation, communicated to the curious *Athan. Kircher* (as may be ſeen in his *Mund. Subterr.*) *viz.* that the ductus's or veins of Metals, do in thoſe parts ſometimes run North and South, ſometimes croſs-wayes, may be relied on?

To inquire into all the Baths of *Baden* and *Hungary*, and the manner of Bathing, uſed there: And particularly, Whether the water of the *Thermæ*, that paſs by *Schemnitz*, depoſe a certain Sediment, which in time turns into a yellow ſtone! And if ſo, to ſend over ſome of it.

Theſe are the Queries; to which we ſhall now ſubjoyn the Anſwers of the above-mention'd curious Travailer, as they were imparted by him at ſeveral times, according as he had occaſion to inform himſelf, when he was in thoſe Parts, about ſuch matters.

—— I have not been unmindful of the Inquiries, you were pleas'd to honour me with upon the accompt of the *Royal Society*; and in Anſwer to them, I ſhall firſt acquaint you with what I found and learn'd of the *Salt-Mines*: concerning which I now preſent you with thoſe two kinds of *Tranſylvanian* Stone-Salts, which you mention'd; and alſo with Salts out of the Mine at *Eperies* in Upper *Hungary*; together with ſome accompt of that Mine.

Of the *Sal Gemmæ* I have ſent you four pieces, and a ſtone of Salt, as it was taken out of the Mine, which, if you pleaſe, for your further ſatisfaction, to break with an Hammer, you will find it to ſplit into Tables or Parallelepipedons in your hand.

With theſe comes along a Specimen of that Mineral Salt, which is commonly uſed at Table. This is found in moſt of the Salt-Mines, as in that of the County of *Maromarus*, nigh to the Caſtle of *Huſt*; and in one at *Des*, in two at *Forda*, in two at *Calos*, in two at *Szick*, and in one at *Dizaknel*.

Great quantity of this Salt is brought down the River *Tibiſcus*, and the Rivers running into it: Some of which is afterwards ſent down the *Danube*, and up the *Morava* to furniſh *Servia*, and the adjacent Provinces; and a great part of it up the *Danube* into *Hungary*; having myſelf ſeen divers Long-boats laden in many places between *Belgrade* and *Presburg*, but they come up no higher; Stone-Salt being prohibited by the Emperour in *Auſtria*, who hath a conſiderable profit upon the boyled Salt brought from *Hall-ſtadt* in that Province.

In my Return from the Mine-Towns in *Hungary*, I met with Count *Rothall* at *Franſchin*, going then from the Emperour to treat with *Abaffi* Prince of *Tranſylvania* his Commiſſioners at *Eperies*: where I engaged ſome of his Attendants, not unknown to me, to make inquiry into the Salt-Mines of that place, or any other, according to the inſtructions I left with them; and afterwards I received an Accompt to this Effect.

Half an hours going from the City *Eperies*, there is a Salt-Mine of great note; from the firſt place of deſcent unto the bottom, it is about One hundred and fourſcore fathoms deep: Into this the Miners deſcend firſt by Ropes, and at laſt by Ladders unto the lower parts. The Mine is for the moſt part in an Earthy, and not a Rocky ground.

The Veins of Salt are large, and there are pieces to be found of Ten thouſand pound weight. They commonly hew out the Salt into Long ſquare pieces of two foot in length, and one in thickneſs; and for uſe, it is broken and grinded between two grind-ſtones.

The Mine is cold and damp; but the Salt being a Stone-Salt, is not eaſily diſſolv'd, or at leaſt in any great quantity, by dampneſs or moiſture: Yet the water of the Mine is impregnated with Salt in ſuch ſort, that being drawn out in large Buckets, and afterwards boyl'd up, it affords a blackiſh Salt, which they give to their Cattle in the Countrey.

The Colour of the ordinary Stone-Salt of this Mine is not very white, but ſomewhat grey; yet being broken and grinded ed to powder, it becomes as white as if it were refin'd: And this Salt conſiſts of pointed parts or foſſets. Another ſort of Salt there is alſo, which conſiſts of Squares and Tables; and a third, to be found of ſomewhat ſtirious or long ſhoots.

Nor is all the Salt of this Mine of one colour, but of divers; that which is found groſly mixt with the Earth, receives ſome colour from it. And even that, which is moſt pure, and reſembleth Chryſtal, doth often receive Tinctures of ſeveral colours. In the middle of a Chryſtal-Salt with long ſhoots, I have ſeen a delicate *blew*; and Count *Rothal* hath a large piece of a fair *yellow*. There are alſo ſome pieces very clear and tranſparent, ſo hard, that they carve them into divers Figures, as Croſſes, Crucifixes, and others. Of each of theſe I have obtain'd a piece, and preſent the ſame unto you *; but cannot omit to advertiſe you, that, whereas theſe Salts, though kept without care, remain'd dry for many months in other Countries, yet they began ſomewhat to relent ſoon after I came into *England*; and if they be kept in a Stove, or very hot place, they will be apt to loſe their Tranſparency. I could not hear of any *Damps* in this Mine.

* *Theſe are now in the Repoſitory of the* Royal Society; *as are alſo the ſeveral Specimens of Ores, hereafter mention'd.*

But to proceed to the Gold-and Silver-Mines, I ſhall tell you, as to the *former*, That among the ſeven Mine-Towns in *Hungary* (which are not far from one another, *viz. Chremnitz, Schemnitz, Newſol, Koningsberg, Bochantz, Libeten* and *Tiln*) *Chremnitz* is the richeſt in *Gold*. They have alſo, at preſent, Gold-Mines at *Bochantz* and *Koningsberg*; and they report in that Countrey, that there hath been formerly a rich Gold-Mine at *Glaſ-hitten*, but loſt, ſince that *Bethlem Gabor* over-ran thoſe parts, when the Undertakers ſtopp'd up the Mine, and fled.

They have worked in the Gold-Mine at *Chremnitz* nine hundred years. This Mine is divers Engliſh miles in length, and about One hundred and ſixty fathoms deep. Many veins of the Ore run to the *North*, and to the *Eaſt*. They work alſo towards One, Two and Three of the Clock, as they ſpeak: for the Miners direct themſelves under ground by a Compaſs, not of 32 points (ſuch as is us'd at Sea) but by one of 24; which they divide, as we do the hours of the day, into twice 12. Of the Gold-Ore, ſome is white, ſome black, red, or yellow: that with black ſpots in white is eſteem'd the beſt, as alſo the Ore, which lieth next to the black veins. This Ore is not rich enough to ſuffer any proof in ſmall parcels, like that of other Mines, whereby to know, what proportion of metal is contain'd in it; but they pound a very great quantity thereof, and waſh it in a little River, which runs nigh the Town. The whole River being divided, and admitted into divers cuts, runs over the Ore continually, and ſo waſheth away the earthy parts from the metallin; and from a clear River above the Town, by its running through ſo many works, and over ſo much pounded Ore, it becomes below the Town a dark yellow ſtream, of the colour of the earth of thoſe hills.

There have been pieces of pure Gold found in this Mine; ſome of which I have ſeen in the Emperours Treaſury, and in the Elector of *Saxony*'s Repoſitory; one piece as broad as the palme of my hand, and others leſs, and upon a white ſtone many pieces of pure Gold; but theſe are very rare.

The common yellow Earth of the Countrey near *Chremnitz*, although it be not eſteem'd Ore, affords ſome Gold: And in one place I ſaw a great part of an Hill digg'd away, which hath been caſt into the works, waſh'd and wrought in the ſame manner, as pounded Ore, with conſiderable profit.

Some paſſages in this Mine, cut through the Rock and long diſus'd, have grown up again; and I obſerv'd the ſides of ſome, which had been formerly wide enough to carry their Ore through, to approach each other, ſo as we paſs'd with difficulty. This happens in moiſt places. The paſſages unite not from the top to the bottom, but from one ſide to another.

There is Vitriol in this Mine, white, red, blew and green; and alſo Vitriolat waters. There is a ſubſtance found, which ſticks to the Gold-ore, of ſmall pointed parts like needles, call'd by them Antimony of Gold. There are Chryſtals found here, and ſome tinctur'd yellow,

The Miners will not allow any Quick-ſilver or Brimſtone to have been found here; yet in the lately mention'd Antimony of Gold there is evidently Sulphur, as you'l perceive by burning it. The Quick-ſilver-mine, mention'd in the Anſwer to *Kircher*'s Inquiries in his *Mund. ſubterraneus*, is an *Hungarian* mile, or 7 Engliſh miles diſtant from *Cremnitz*, and is not wrought in at preſent.

There is a Vitriol-mine in theſe Hills nigh the Gold-mine; the Earth or Ore of it is reddiſh, and ſometimes greeniſh. This Earth is infuſ'd in water, and after 3 dayes the water is powr'd off, and boyl'd 7 dayes in a leaden Veſſel, till it comes to a thick granulated whitiſh ſubſtance, which is afterwards reduced to a *calx* in an Oven, and ſerveth in the making of *Aqua-fortis*, or the ſeparating water, uſed at *Schemnitz*.

They have divers wayes of taking the Gold out of its Ore; by burning the Ore, by melting, by adding Silver-Ore and other Minerals, Sand and Lead; as they find the Ore fluid or fixt. But, to avoid prolixity, I will ſet down that way only, which they proceed in without Lead.

They break and pound the Ore, in water, very fine; they waſh it often, and lay it in powder upon cloaths, and by the gentle oblique deſcending of the water over it, and their continual ſtirring it, the earthy, clayiſh, and lighter parts are waſht away, while the heavier and mettalline remain in the cloth. Theſe clothes are afterwards waſht clean in ſeveral Tubs, and the water, after ſome ſettling, powr'd off from its ſediment; which ſediment is again waſht, and ſtirr'd up in ſeveral veſſels and troughs, till at length they ſprinkle Quickſilver upon it, and knead it well together, for an hour, and then waſhing it again in a wooden veſſel, after the ſeparating of much of it which the Quickſilver touches not; by ſtriking this veſſel againſt their leg, they bring the Gold and Quickſilver together, in an Amalgama, to one corner of it. From this Amalgama they ſtrain as much of the Quickſilver as they can through coarſe clothes firſt, and then through fine: they put the maſs remaining upon a perforated Plate, which they ſet over a deep pan placed in the earth; in in the bottom of which pan they alſo put quickſilver: This pan they cover, and lute the cover well and then make a charcoal-fire upon it; they drive down the Quickſilver yet remaining in the Gold to the reſt in the bottom of the pan; then taking out the Gold, they caſt it into the fire, that it may ſtill become purer.

Concerning *Cranach*-Gold (of which you particularly inquire) I cannot learn, that there is any ſuch Gold, or place where Gold is digg'd, in *Hungary*; but in *Germany*, I think, there is: for *Agricola* mentions ſuch a place as *Golde-Cranachum* in his ſecond Book *de veter. & novis Metallis p.* 400 *inter Francos*; and in his fifth Book *de Natura Foſſilium p* 254. mention is made of one place call'd *Golde-crona*, and another nam'd *Golde-Cranacum*.

Concerning the *Silver-mines*, there are divers of them at *Schemnitz* in *Hungary*, as the *Windschacht*, the *Trinity*, of *St. Benedict*, of *St. John*, of the *three Kings*, and ſeveral others of leſſer note. The chiefeſt and moſt wrought are thoſe of *Windſchacht* and *Trinity*.

They have no River here, but much water in the Mines, which is a double inconvenience to them, *viz.* to want water above, and to be glutted with it under ground, ſo as they are conſtrained to ſend much of their Ore to *Hodrytz* and other places, where are ſmall Rivers, by which their Bellows and Hammers may be mov'd, their Ore pounded, waſhed, and other works requiſite performed. Nor do they want Engins to pump the water out of the Mines, mov'd by wheels drawn about continually by horſes, 12 horſes at a time to each wheel.

In *Windſchacht*-mine, deep in the earth, is a large wheel of 12 yards diameter, turn'd about by the fall of ſubterraneous waters. This wheel moves Engines, which pump out the water from the bottom of the Mine up to the cavity, wherein this wheel is placed. The water, which moves this wheel, falls no lower into the Mine, but paſſeth away through a *Cuniculus* made on purpoſe, through which both this & the other water, pump'd from the deepeſt parts of the Mine, do run out together at the foot of an Hill.

Trinity-Mine is 70 fathoms deep; built and kept open with underwork at a great expence. Much of this Mine being in an earthy ſoyl, the Ore of it is much eſteemed. Divers veins lye *North*; and other rich veins run to the *North-Eaſt*. When two veins croſs one another, they eſteem it fortunate. So that all veins of Ore keep not the ſame point even in the ſame Mine; which would be an help to diſcover them; but they have no certain way to know either which way they run, or where they are, till by the induſtrious perſevering in the labour of the Mines they are at laſt found out. They uſe not the *Virgula divina*, but dig alwayes as the Adventurers deſire. They ſhew'd me one place, which they had digg'd ſtreight on 6 years, when the Ore was but two fathoms diſtant from the place where they firſt began: And in another place they digg'd 12 years outright, and at laſt found a vein, which in a ſhort time paid their charges.

The blackiſh Silver Ore is eſteem'd the beſt; much of it hath a mixture of a ſhining yellow ſubſtance or Marchaſite, which if it be not in too great a quantity, is not unwelcom, by reaſon that it diſpoſeth the Ore to fluidity or renders it more eaſie to be melted; but if it be in too great a proportion, they are of opinion, that it preys upon the Silver in the Mine, and in the Furnace carries it away while it melteth, by overvolatilizing it; and therefore they term it a *Robber*, as a ſubſtance which ſpoyls, and takes away the richneſs of the Ore.

There is often found a red ſubſtance, which grows to the Ore, called Cinnaber, Cinnaber of Silver, *Cinnabaris nativa*, *Minium nativum*, or *Berg-cinober*; of which I have ſent you ſome by it ſelf, and ſome alſo ſticking to the Ore. This ſubſtance grinded with oyl maketh a Vermillion, equal to, if not ſurpaſſing, the Cinaber made by Sublimation. I diſcover'd a Sulphur in it, by caſting it upon an hot Iron-plate, on which it burned blew. Whether it alſo contains Quick-ſilver, I have not try'd, becauſe I would not diminiſh that ſmall quantity, here ſent. The Miners ſay they meet not with any.

There are alſo found in theſe Mines, Chryſtals, Amethyſts or Amethyſtine mixtures in the clefts of the Rocks, and ſometimes nigh or joyn'd to the Ore; as alſo Vitriol, naturally chryſtalliz'd in the earth in divers of theſe Mines, and particularly in a Mine in *Paradiſe*-hill near *Schemnitz*.

As there is great variety in the Silver-ore, as to its mixtures with Earth, Stones, Marchaſite, Cinaber, Vitriol, &c. ſo alſo in its richneſs, ſome holding a great proportion of Silver in reſpect of other. An 100 pound weight of ore ſometimes yields but ½ an ounce or an ounce of Silver; ſometimes 2 ounces, 3, 4, 5, and unto 20 ounces. What is richer is very rare; yet ſome hath been found to hold half ſilver, and I have ſeen of it ſo rich, as to be cut with a knife.

A Specimen of each ſort of Ore, which they dig out of the Mines, is carried to an Officer call'd the *Probierer*, who is to prove and judge of its richneſs; which he doth in this manner. Of all ſorts of Ores he taketh the ſame quantity: the Ores being firſt dryed, burned, and pounded, he giveth an equal proportion of Lead to all, melteth and purifieth them, and then by exact ſcales takes notice of the proportion between the Ore and the Mettal contain'd in it, and reports it to thoſe employ'd in the great melting Furnaces.

If the Ore be found to hold 2 ½ ounces or more of ſilver in 100 pound weight, they ordinarily melt it without any foregoing preparation, by the help of *Iron-ſtone* (which is not Iron-ore, but a ſtone found thereabout, of which the liver-colour'd is the beſt,) *Kys* (a ſort of *Pyrites*) and *Slacken* (a ſcum or cake taken off from the top of the pan, into which the melted Minerals run, and is a ſubſtance made out of the former mention'd, by fuſion;) which are thrown in with it into the melting Furnace.

If the Ore be poorer, holding but two ounces in an 100 pound weight, or leſs, it is firſt pounded and waſhed, till it becoms richer, or hath a greater proportion of Metal in reſpect of the Ore, much of the earthy parts being waſhed away. Then it is thrown into the Furnace with the former Materials; and the Marchaſite, which remains ſtill with it, as ſinking alwayes to the bottom with the ſilver in the waſh-works, helps to the quicker fuſion of the Ore.

Whatſoever is melted in the melting Furnace, is let out through an hole at the bottom thereof into the pan, which is plac'd in the earth before it, and, thus expos'd, it immediately acquires an hard ſcum, droſs, loaf or cake, which being often taken off from the top, the metal remaining in it becoms purer; to which is added Lead, and after ſome time the melted metal is taken out. Then being again melted in the Driving Furnace, the Lead, or what elſe remains mixt with the Silver is driven off by the blowing two great bellows, and runs over in the form of Litharge: that which firſt comes over is the *White*, and that which laſt, being longer in the fire, is the *Red*, not that it is Litharge of Gold, both being driven off from the ſame metal.

As *Chremnitz* Gold-ore hath Silver in it, ſo moſt of the *Schemnitz* Silver-ore holds ſome Gold; which they ſeparate by melting the Silver, then granulating it, and afterwards by diſſolving it in *Aqua fortis*, whereby the Gold is left at the bottom, and is afterwards melted; the *Aqua fortis* is diſtilled from the Silver, and ſerveth again for uſe.

The Silver then ſeparated from all its former aſſociats, is ſent to *Chremnitz*, where they coyn it into pieces of a mixt metal (which is the common Money of the Country,) after this manner: They melt it with about the ſame quantity of Copper, and run it into Bars, which they beat out; then ſoftning them in the fire, draw them out to an exact thinneſs between two Steel-Wheels; then they cut them out into round pieces with an Inſtrument like a Shomakers Punk, and then boil them with Tartar and Salt, ſhake them in a Sack with Small-coal and Water, dry them in a Kettle perforated, and afterwards they are drawn between two Wheels, in which they receive their Stamp.

So far this generous Travailer of the Hungarian *Gold-and Silver-mines: what he hath obſerved concerning the Copper-mines, and the Baths in thoſe parts, we muſt referr to the next opportunity.*

Some Inquiries relating particularly to the Bleeding of Walnuts; *ſuggeſted by Dr.* Ezerel Tonge *in a Letter of his to the Publiſher, of* March 22. 1670.

After I had been troubled a while at the Obſervation of Mr. *Willoughby*, concerning *Sycamores* ſtaying in hot, and running in cold weather, and had re-commended an *Hypotheſis* to ſalve the *Phænomena*, and to reconcile the ſeeming repugnancy's *, he hath rais'd two other difficulties for me, of *Sycamores* running in *November*, and *Walnuts* never running but in cold weather: The *former* of which Obſervations puts me out of conceit of a *Salvo*, I found, and offer'd, in my publiſht Papers, to *Birch* ſuppos'd to have run in *Autumne*, and found to have jelly'd the hole full at *Spring*, which was bored that time Twelve-Moneth before; and yielded not any ſap at all that *Spring*, as far as could be obſerv'd, and was not come to its ſeaſon of bleeding the ſecond *Spring*, when the Jelly was obſerv'd in the bor'd hole *. The *latter*, of the *Walnut* not bleeding but in cold weather, being inconſiſtent with the Obſervations, often made by me of that Tree, not only bleeding and bleeding longer in warmer weather, but bleeding longer at the roots on the South-ſide in the Sun, than on the North-ſide in the Shade, and conſtantly governing the Courſe of its Sap in its beginning to riſe and to ſtop daily at the riſing and ſetting of the Sun; I ſhall betake my ſelf, inſtead of opining, to make ſome naked *Queries* for the finding out the matter, *viz.*

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* *Of which in* Numb. 57. p. 1165, 1166.

* *See* Numb. 44. *p.* 880.

1. Whether this Obſervation of Mr. *Willoughby*'s concerning the *Walnut-Tree*, was in Roots, Body, Branches; all, or ſome, or one?

2. Whether the Sap of a Tree, as to its motion, be not influenced from the Full or Wane, or other Aſpect of the Moon to the Sun, *&c*?

3. Whether the *Walnut*, being a more ſolid Wood, have not ſome alteration as to heat, aſcent of Sap, *&c.* from thence different from *Birch*?

4. What the Age and Bulk of the Tree, conſuming perhaps inſenſibly what roſe inſenſibly in hot, not in cooler Weather?

5. What the time of the Year? The *Aſpes* run only, as M. *Midford* relates, before *February*; the *Hopp* about Hopp-harveſt. *Withies* in *April*, &c.

6. Whether the weight of the Atmo-ſphere will put ſome check to Sap riſing in that part of the Root, which is cut off from the Body? And whether the excluſion of that Impediment, by cloſing the cut Root in Glaſs, will cauſe any ſenſible alteration: to be tried in ſeveral Roots of the ſame Tree of like Diameter.

I want a good *Thermometer*, *Barometer*, and *Hygro-meter*, (or if you will have Engliſh Names for them, a Heat-Weight-and-Wet-Wiſer) to make more accurate Obſervations, how far the aſcending of Sap depends on the Air, and the ſeveral temperatures of the ſame.

An Extract of a Letter

Written by Francis Willoughby *Eſquire to the Publiſher, containing ſome Obſervations of his made on ſome* Sycamore-Trees, *the* Black-Poplar, *and the* Walnut: *As alſo his thoughts about the* Dwarf-Oaks, *and the* Stellar Fiſh *deſcribed in* Numb. 57.

I Am ſorry, I cannot return you a better Anſwer to yours of *March* 19; the Experiments, which our leaſure hath ſince permitted us to make, being not ſufficient to found a new *Hypotheſis* on, to confirm Dr. *Teng*'s. Since the Leaves have been explicated, we have obſerv'd the *Sycamore* after ſeveral froſty nights to bleed afreſh in the morning, ſoon after Sun-riſing, when it had ceaſed ſeveral dayes before: Though this muſt not be underſtood of all Sycamores, but of ſome only that are more ſenſible and obſervant of the Weather.

April 3d. and *4th.* all the Sycamores quite ceaſed.

The *5th.* being after a white froſt, they began to bleed about 8 a clock, and ceaſed towards noon.

The *9th*, *12th*, *13th*, *15th* they bled again.

The *10th*, *11th*, *14th* were not obſerved.

This *16th* they bled not, it being rainy, and the Sun not ſhining.

From the Obſervations we have hitherto made, we think it may be certainly inferr'd, that a morning-ſun after a froſt will make all the Bleeding Tribe bleed afreſh, though they had before ceaſed; and that this new bleeding towards the latter end of the ſeaſon commonly ceaſeth before morning. Poſſibly ſome may bleed after a froſt, yet further in the Summer.

I obſerved laſt year in *Auguſt* a copious and ſpontaneous exudation, very like bleeding, of a viſcous yellow Juice out of the buds of a black Poplar. Our *Walnut*-trees bleed here in *January*.

The *Starre-fiſh,* in the laſt *Tranſactions,* is the *Stella arboreſcens Rondeletii p.* 121. firſt deſcribed by him, and ſince by other Naturaliſts.

There is no ſuch dwarf-*Oak* in *Old England,* growing wild, as was ſent you out of *New-England,* nor in any other Country, where we have been, unleſs it be the *Ilex coccifera,* which is a low ſhrub, bearing large Acorns, and hath a prickly leaf like Holly. If it prove that, it will be a lucriferous diſcovery. ——*Midleton* in *Warwickſhire April* 16. 1670.

An Account of ſome Books.

I. Joh. Sig. Elſholtii, Elector. Brandenburg. Medici, *CLYSMATICA NOVA*, *ſive Ratio in venam ſectam Medicamenta immittendi. COLONIÆ BRANDEBURGICÆ.* 1667. in 8°.

THe *Title-page* of this Book, but very lately come into *England,* ſhews this to be the *ſecond Edition*: and the Author in the Concluſion of it tells the Reader, that the *firſt* Edition thereof was publick *A.* 1665. at which time he affirms there had been nothing printed (for ought he knew) either by *Engliſh, French,* or *Italians,* of this argument. To which we ſhall here ſay nothing, but refer the Candid Reader to what hath been ſaid already (by way of vindicating the Invention, both of *Infuſing* Medical Liquors, and of *Transfuſing* Blood, from uſurpation)

pation) in ſeveral of theſe Tracts, as *Numb.* 7. *p.* 128. *Numb.* 20. 353. *Numb.* 22. *p.* 385. *Numb.* 35. *p.* 677, 678, 679, 680, 681.

Mean time, this Author, having collected in this little Tract divers of the Experiments, made in *England*, *France*, and *Italy*, concerning theſe Inventions (of which we might have a far greater ſtock, and that a very conſiderable one, as to that of *Infuſion*, if our Learned and Candid Doctor *Timothy Clark*, one of his Majeſties Phyſicians in Ordinary, and a Fellow of the *R. Society*, could but find the leaſure of digeſting for the Preſs what he hath done on this ſubject many years ago) diſcourſeth of the particular Diſeaſes, wherein this Infuſing Chirurgery hath been uſed with ſucceſs, and ſuggeſts thoſe, to which it might be further extended with benefit.

II. Nicolai Hobokeni *ANATOMIA SECUNDINÆ HUMANÆ, Ultrajecti A.* 1669. in 8°.

THis Author, intending to inquire more narrowly into all the particulars concerning *Humane Generation,* premiſeth theſe Obſervations, touching the *Humane Secundine*, lately made by himſelf, and accompanied with 15 accurate *Schemes*, drawn, (as he ſaith) by his own hand, and repreſenting;

Firſt, in a Female *Fœtus*, the *placenta uteri*, together with the Membranes and String, on both ſides, where the ſame reſpects the *uterus* as well as the *fœtus*; and more particularly the Membrane *Amnios*, ſever'd from the *placenta*, and the Veſſels running through the other Membrane, *Chorion*; then, that portion of the ſtring, wherein the laxeneſs, inequalities and contorſions of the Membrane, together with all the contain'd veſſels in their proper ſcituation, are obſerv'd; next, the *Macula*, appearing ſomewhat prominent in one of the Arteries, by which may eaſily be found the paſſage of the Bloud to the *Placenta*, and its difficult regreſs towards the Navil of the *Fœtus*; more-over, the interiour ſubſtance of the *placenta*, and all the ramifications of the Veins and Arteries.

Secondly, in a Male-*fœtus*, a review of all the former particulars, together with ſeveral differences from that of the Female.

To theſe Obſervations is ſubjoyn'd a Collection of Letters, written by this Author to divers Learned men, touching *Generation*, together with their Anſwers: In which Collection 'tis intimated, that the Curious may now expect from Dr. *Dimerbroeck*, the famous Phyſitian of *Utrecht*, his Anatomy, which by reaſon of his great practiſe, and a multitude of other avocations hath been hitherto retarded.

III. Joh. Ludov. Ganſii *M. D.* CORALLIORUM HISTORIA. *Francofurti A.* 1669. *in* 12°.

IN this Hiſtory the Author affirms to have digeſted both what hath been deliver'd of *Corals*, and what himſelf hath obſerv'd and try'd of that curious product of Nature, taken notice of by the Poet, 4. *Metam.*

> *Sic & Coralium, quo primum contigit auras*
> *Tempore, dureſcit, mollis fuit herba ſub undis.*

Which affirmation this Author looks upon as poetical indeed and fictitious, aſſerting, that Coral is originally a Mineral, and a kind of precious Stone, Corals being no berries petrified, but pieces filed off and turn'd, from the trunck, round and poliſht.

His opinion therefore is, that Coral is form'd out of a glutinous Juyce, which being turn'd into Stone by a ſalt, abounding in it, riſeth up in the form of a Shrub, the ſalt being the cauſe, that maketh Plants ſpread into branches.

The places of the production of Coral he names to be, the *Red Sea* (where they are darkiſh,) the *Perſian Gulf*, the *Sicilian* and *Neapolitan* ſhore. Some of them are Red, others White, others Blackiſh.

To this Accompt he annexes various Preparations made of them; as alſo divers Solutions, of which he delivers one as an excellent diſſolvent both of Corals and Pearls made of very well rectifi'd ſpirit of Salt, digeſted, and freed of its Corroſiveneſs, and then mixt with good ſpirit of Wine diſtill'd and brought over the Alembic. *May*-Dew is alſo much commended by him for a fit *Menſtruum*, if the ſpirits diſtill'd from it be joyn'd with its own Salt.

He treats alſo of the Magiſteries, Extract, Oyl, Tincture, Quinteſſence, Flowers; as alſo of the Vertues of Corals, and of the way of making factitious ones.

ERRATA, left uncorrected in ſome of the former Tracts

In No 54. p. 1082. l. 14. r. 4000. ib. l. 32. r. *Carniola* for *Carinthia*, p. 1083. l. 16. r. the *Rocks*, p. 1084. l. 19. r. *upon retiring* of the waters.

In No 56. p. 1135. l. 26. r. *our Iſland*, p 1137. l. 16. r. *britle diamonds*, ibid. l. 26. r *or digg'd*, p. 1138. l. 35. r. *were a continued and entire*, p. 1139. l. 35. r. *ſtrait or through winding*.

In No 57. p. 1147. l. 5. r. *communications*, ibid. l. ult. r. *deſire*, p. 1155. l. 33. r. *cleanſing*, p. 1158. l. 24 r. *found by*, p 1171. l. 18. r. *planetæ*, ib. *ſpectatur*, ib. l. 19. *ſpectatur*.

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PHILOSOPHICAL TRANSACTIONS.

May 23. 1670.

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The Anſwer of Monſieur Marriotte *to Monſieur* Pecquet, *concerning the Principal Organ of Viſion; where occurr divers conſiderable Experiments. A Continuation of Dr* Edward Brown's *Account concerning the Mines of* Hungary; *where is a particular relation of the Hungarian Copper-mine, together with a Narrative of the many natural Baths in that Country and in* Auſtria. *An Account of 3 Books: I.* COSMOPOEIA DIVINA, *per Ludov. de Beaufort M.D. II.* CARTESIUS MOSAIZANS, *Auth. Joh. Amerpoel. III. The* DIVINE HISTORY *of the* GENESIS *of the* WORLD, *explicated and illuſtrated.*

The Anſwer

Of Monſieur Mariotte *to Monſieur* Pecquet, *about the Opinion, that the* Choroeides *is the Principal Organ of Sight; communicated to the Publiſher from* Paris, *and Engliſhed as follows.*

SIR,

I Have in your Anſwer * ſeen the reaſons, which hinder you from believing that the *Choroeides* is the Principal Organ of Sight; but though they were very Acute, and carried a great deal of Probability with them, yet I did not find them ſtrong

* *Vid. N°. 35. of theſe Tracts,* p. 668, 669, 670, 671.

enough to oblige me, to grant back again this Preeminence to the *Retina.*

You ſay, in your *firſt* Objection, that if the *Sclerotis* and the *Choroeides* be taken away from an Eye that is very freſh, and that the *Retina* be left diſtended on the Vitreous Humor, one ſhall not be able to ſee well through this membrane: whence you conclude, that it is not tranſparent enough, to let ſo much light, as is ſufficient for viſion, paſs upon the *Choroeides.*

In my opinion, there is good reaſon to doubt of this conſequence, ſeeing there may be a great deal of difference between the Retina of a dead Animal, after it hath been expoſed to the Ayre, and that of a living Animal, while it is exactly ſhut up between the Vitreous humour and the *Choroeides.* Different diſpoſitions do ordinarily change the qualities of things; Fat, which is tranſparent when it is melted, grows opacous after it is cold again; and the *Tunica cornea* of an Eye being held ſome hours in ones hand, in a hot Ayre grows thick, and a little after entirely opacous. But to the end you may be perſwaded, that the *Choroeides* is ſufficiently enlightned in a living Animal, you muſt take the Eye of an Ox (newly kill'd) while it is hot, and cut it in two, in ſuch manner that a good part of the vitreous humour may remain extended upon the *Retina*; then you ſhall ſee diſtinctly the colours of the *Choroeides*, the baſis of the Optick nerve, the trunck of the little veſſels which proceed from thence, and their diſperſion through the thickneſs of the Retina, with ſo much perſpicuity that you cannot even diſcern, whether there be a Retina beyond the Vitreous humour or no. Hence you may judge, that the light, which the Objects ſend to the *Choroeides*, is more than ſufficient for viſion, ſeing that being much weakned by the reflexion and by a ſecond paſſage through the Retina and the Vitreous humour, it is yet ſtrong enough to form a clear and diſtinct viſion of the *Choroeides* in our Eyes.

Not that I deny the Retina to have ſome whiteneſs in a living Animal, and that it is a little leſs tranſparent than the other Humours, chiefly in that part which is contiguous to the *Choroeides*; and Nature may have made it ſo on purpoſe to temper the brightneſs of great lights, and to hinder dazeling; in like manner as ſhe hath ſpread over our skin an inſenſible *Epidermis*, to keep it from being too eaſily hurt by thoſe bodies that touch us, and by the Exceſs of heat and cold. But if I ſhould abſolutely deny, that the Retina hath any opacity in a living Animal, your Experiment would not convince me, it being made but upon a Retina, whoſe more ſubtle and tranſparent parts are evaporated; and I might propoſe to you for an example a piece of white paper, through which, when it is wet, one ſees diſtinctly enough whatever is contiguous to it; and which preſently reſumes its firſt opacity, when it is a little while expoſed to the Air: And if this Example were not ſufficient, I might alledge the little Chryſtalline, which is found in the middle of the Chryſtalline humour of many Animals, and is as it were the kernel of it; the which, being as tranſparent as the other humours of the Eye in a living Animal, becomes in two or three dayes after his death white and opacous, notwithſtanding that it be left incloſed in the Eye, and that the Exteriour Chryſtalline remain ſtill tranſparent.

Your *ſecond* Experiment to prove the opacity of the Retina, which is to put it into water, is alſo extremely deceitful: For, you make no doubt but the *Hyaloeides*, which invelopes the Vitreous humour, is perfectly tranſparent: neverthele ſs if you lay in a diſh half full of water, part of the Vitreous humour, the parts of the *Hyaloeides*, which ſtick to it, will appear whitiſh and thick like a ſpiders web, although the Vitreous humour do ſtill retain its tranſparency. It is not then a ſufficient proof to know, whether the Retina be opaque in a living Animal, by putting it into the water: And by what tryal ſoever you make of it, after it has been expoſed to the Ayre, you can draw no conſequence to prove that it is opaque in its Natural ſtate: For the Chryſtalline it ſelf becomes a little thickiſh in water, and if it be left there ſome time, or expoſed to the froſt, it becomes white and opaque like ſnow.

It is therefore neceſſary for reſolving our difference, and for knowing with certainty, whether the light of objects paſs almoſt all entire to the *Choroeides*, or whether it is almoſt all intercepted by the *Retina*, to bring obſervations made on the *Retina* and the *Choroeides*, while they are in their natural ſtate, as I ſhall do in the following Experiment.

Place by night a lighted Candle very near your Eies, and cauſe a dog, diſtant from the candle 8 or 10 paces, to look upon you, then you ſhall ſee in his eyes, a light ſufficiently bright, which I hold to proceed from the reflexion of the light of the Candle, whoſe image is painted on the *Choroeides* of the dog, which having much whiteneſs and luſter cauſes this very ſtrong reflexion; for if it proceeded from the Chryſtalline or Retina, the ſame appearance would be ſeen in the Eyes of Men, Birds, and other animals, who have the *Choroeides* black, which is not found ſo by us. It is therefore manifeſt by this Experiment, that the luminous rayes do paſs with a great deal of force as far as the *Choroeides*, and that the *Retina* receives very little impreſſion. Now this appearance is made in this manner: The little picture of the candle which is upon the *Choroeides* of the dog, (where is the *Focus* of the Chryſtalline and other humours together) ſending rayes back through theſe humours, makes its reciprocal *Focus* towards the candle, and by conſequence the eyes which are near to the point, where theſe rayes do reunite, ought to ſee the Chryſtalline of the dog very much illuminated. They that are skilled in Opticks know the demonſtration: and there is an effect, wholy like unto this, to be ſeen by a very eaſy Experiment.

Place a round Glaſs-bottle, full of very clear water, 8. or 10. paces from a Candle, and put behind the bottle, at near the diſtance of its Semidiameter, a white paper, in ſuch manner that one may ſee the light of the Candle, which hath paſſed thorow the bottle, reunited in a little ſpace upon the Paper; then they, who have their eyes near the Candle, ſhall ſee the bottle full of light, which will diſappear, if you hold the paper either nearer to, or farther from the bottle. And if one hold a ſmall lighted wax-candle in the place of the Paper, and you hold your eye in the place of the former candle, you ſhall ſee the bottle yet more enlightned then it was before: And one may eaſily judge, that the light which appeareth in the dogs eye, proceedeth from a like cauſe. The ſame experiment may be made in the eyes of ſeveral other Animals, and particularly of Cats, in whoſe eyes this light appears blewiſh, which ſhews, that it proceedeth from their *Choroeides* which hath much of this Colour; but this Colour, nor any other which may be in the *Choroeides*, brings no confuſion to the Senſe of Seeing, for the Senſes receive no impreſſion from their own Organs.

The reſt of this firſt Objection hath almoſt no other foundation, but an interpretation you give to ſome words of my writing different from my ſenſe; for, when I ſaid, that dark and opaque bodies receive a great deal of impreſſion from the light; I did mean dark and opaque bodies both together; for it had been ſufficient for me to name dark bodies, ſince all dark bodies are opaque; but my thought on this ſubject was, and ſtill is, that tranſparent bodies, as the Ayre, the Water, and the Retina in a living Animal, receive *little* impreſſion from light, and that Opaque bodies receive a *great deal*, but that dark bodies receive more then all other Opaque bodies, and the Air and the Water a little leſs than the Retina.

Nor do I believe, that darkneſs is abſolutely neceſſary for Viſion, but only for a ſtrong viſion; nor that the picture of objects ought to be expreſſed on the Organ of Viſion; for, it ſufficeth, that the rayes of each point of the Objects be reunited in a diſtinct and ſeparated point, according as they anſwer one another; and you will eaſily agree, that as a Convex glaſs makes the image of the Sun to appear on white paper with a great deal of brightneſs and light, and on black paper very obſcurely; although black paper (which ſoon takes fire) receives a great deal more impreſſion than white: So the rayes of illuminated objects do reunite on a whitiſh *Choroeides*, and expreſs there a viſible picture, and on a dark *Choroeides*, a very obſcure one, and which cannot be ſeen; but then the impreſſion is alſo much ſtronger in the black than in the white: And this is the cauſe, why Men and Birds ſee better and more diſtinctly then the greateſt part of other Animals; for their *Choroeides* being black, and by conſequence very ſenſible of light, they contract much their pupilla or ſight-hole of the Eye, which makes the Rayes, that paſs there from each point of the Object, to be all very near the

Axis of the Chryſtallin, and to reunite more exactly in a point, then in the Eyes of moſt other Animals, which have their *Choroeides* white towards the *Axis* of Sight, and by conſequence leſs ſenſible of light, who in recompence can very much dilate the Pupilla of their Eyes when they ſtand in need of a great light; but alſo their Sight is not ſo diſtinct, becauſe the Rayes, which fall on the Extremity of the Chryſtalline, do interſect the Axis too near in their refraction.

It is true, that to ſupply in ſome ſort this defect, they have a little Chryſtalline in the middle of the great one, and this little Chryſtalline being of a more ſpiſs conſiſtence then the great one, its refraction is alſo more ſtrong, and makes the rayes, which come from one point in the *Axis* and paſs near the Center of the Chryſtalline to refract more then if there had been but one Chryſtalline. And by this means the greateſt part of the Rayes, which fall upon the Extremity of the great Chryſtalline, do interſect the *Axis*; which cauſes their ſight to be leſs confuſed, although it be never ſo diſtinct as that of Men and Birds, which have but one Chryſtalline. *Fiſhes* have alſo a double Chryſtalline, for otherwiſe their ſight would be more confuſed than that of other Animals who live in the Air, for their Chryſtalline being ſpherical, the rayes cut the *Axis* more unequally than if it were lenticular and its convexities were of a greater ſphere; and it ought neceſſarily to be ſpherical, becauſe the refraction of the Rayes, which paſs from the water into the Chryſtalline, is very ſmall, and would make its *focus* too far diſtant if the Chryſtalline were lenticular.

The difficulty of your *Second* objection proceeds alſo from an Ambiguity of words, and conſiſts in knowing, what we are to ſay it is, that has a great continuity and communication with the Brain. My *Hypotheſis* is, that the Nerves are all coated with the *Pia Mater* (which envelops all the Spinal Marrow) and have with it the ſame continuity of fibers; ſo that if theſe nerves be never ſo little moved, the impreſſion is carried to the Brain by the Continuity of theſe fibers; and whether it be, that the texture is different in Nerves of different ſenſes; or that they contain ſome ſpirituous liquors which determine their ſenſations, by ſome differences they have among themſelves; it is certain, that the Nerves of Sight, in what manner ſoever they are moved, repreſent Colours and Lights; thoſe of Hearing, Sounds, and thoſe of the Touch, Paines, &c.

Now the *Choroeides* is an Expanſion and dilatation of the *Pia Mater*, which enveloppes internally the Optique Nerve, and which comes from the tuberoſity of the Spinal Marrow, by a continuity of fibers; whence it follows, that how little ſoever the *Choroeides* be toucht, the impreſſion may be eaſily communicated to the brain: And to the end, that the ſame thing may be ſaid of the *Retina*, there muſt be a little channel in the Optic nerve, through which the Retina in its proper Subſtance extends it ſelf to this tuberoſity by a continuity of Fibers; which is not ſeen, and you are conſtrained to ſay, that there are little filaments of nerves which come from the interiour of the Optick, and expand themſelves through the Retina, which have this continuity; but if there were theſe filaments, they ſhould ſpread themſelves through the Retina, as from a Center to a Circumference, and ſhould lye cloſer together near the Optick nerve, than a good way farther in the Retina: which nevertheleſs we do not obſerve to be ſo.

Beſides, if you thruſt a pin through the thickneſs of the Retina, you will often meet with filaments; but if you look on them through a Convex glaſs, you will diſcover, that they end in little veſſels of Veins and Arteries, which are in the Retina; and infallibly, if there were any nerves, you might find them in the ſame manner, and they would ſtop the Pin, ſince they are as hard and firm as the little Arteries; and when you ſay, that one may diſtinguiſh theſe filaments in the water, becauſe the reſt of the Retina diſappears; that is repugnant to experience, and to what you have ſaid before, *viz.* that the Retina may be ſeen all white in the water, and without tranſparency; and you ought to ſhew theſe filaments, or elſe we ſhall take them for a thing invented at pleaſure.

You bring after that two Experiments; the *firſt* of which is, that if an aperture be made on the upper part of the Eye, we may diſcover the Picture of the Objects on the anterior ſurface of the *Retina*; but if this aperture be made in the white of the

Eye, the aqueous humour will run to the *Tunica Cornea*, and make wrinkles, which will hinder the Picture from being diſtinct: Beſides, he that looks in at this aperture, will hinder the Rayes of the Object from paſſing into the Eye, and he ſhall ſee nothing there but his own image. But if you mean, that the *Tunica Cornea* ſhould be wholly taken off, there will not then be diſtance enough between the *Chryſtallin* and the *Retina*, to make the Picture diſtinct. In concluſion, I do not believe this Experiment can be made, much leſs that it is to be diſcerned whether this Picture be formed on the anteriour or poſteriour ſurface of the *Retina*, ſince the thickneſs of it is leſs than half a line, or the 24*th* part of an inch; and there is reaſon to believe, that you have truſted to the report of ſome other concerning this Experiment; or that you have believed the images which appear in the Eyes to be painted on the *Retina*, whereas they proceed from the reflexion made on the exteriour of the *Cornea*.

Your *ſecond* Experiment is true and eaſie to be made, but according to you it were impoſſible; for, ſince you hold, that it is on the anteriour part of the *Retina*, that the Picture is ſeen, and that you have elſewhere ſaid, that one cannot well ſee through this Membrane, it follows, that you cannot ſee this Picture through the thickneſs of the *Retina*; but becauſe I believe, there remains tranſparency enough in that part of the *Retina* which is not expos'd to the Air, I doubt not but the Picture may be ſeen on the poſteriour part of it, after it is become ſufficiently opake, though in a living Animal this Picture paſſeth as far as the *Choroeides*, as it hath been already proved: and if the *Retina* it ſelf were taken away, and there remained only the vitreous humour, you might notwithſtanding ſee the inverted Picture of the Windows toward the bottom of the Eye, if you held it at the farther ſide of the room; in the ſame manner as the Picture is to be ſeen in the *Focus* of the ſpherical Glaſs-bottle fill'd with water, though it ſeem to be on the exteriour ſurface of the Glaſs; and by conſequence this Experiment proves not the opacity of the *Retina*.

In your *third* Objection you quote, what I ſaid, a little otherwiſe than I ſpoke it; for I put in my Writing, that the *Retina* was *about* half a line in thickneſs, and not half a line *preciſely*; which misspaged

which ſhew'd, I had not meaſur'd it exactly; but if it were but a quarter of a line or leſs, it ſufficeth that it had enough for the effect I did attribute to it: And for another, I did alſo mention in my Writing, which is, that the Rayes of the ſame luminous point, which do not unite preciſely in the ſame points in the *Axis*, are rectified by the concavity of the *Retina*, thoſe that are fartheſt off the *Axis* more than thoſe which are the neareſt, which is the reaſon they unite better in the ſame point on the *Choroeides*; the which point I hold (with you) to be *Phyſical*, ſince the points objective are ſo too; but I hold it to be leſſer than any that can be perceptible to the ſight; for we diſtinguiſh the different parts of very ſmall objects, as the extremities of the breadth of the little arteries of the *Retina*, which make not an eigth part of its thickneſs; and that which repreſents this ſmall breadth, muſt be 25 or 30 times leſs in the Organ of our ſight, that is to ſay, in the proportion of the diſtance of the Object, to the Centre of the ſight, and of the diſtance of this Centre, to the Organ of viſion; and by conſequence the thickneſs of the *Retina* is not proper for this ſmallneſs.

You ſee, then Sir, that hitherto your objections have been able but very lightly to ſhake my opinion, and that the tranſparency of the Retina is well enough eſtabliſhed: Let us come now to the proof, I make of the *Want of Viſion*, on the Baſis of the Optick Nerve.

It muſt firſt of all be agreed, that in this Experiment, almoſt all men do looſe ſight of an intire circle of white paper, whoſe diameter is about the *9th* or *10th* part of its diſtance from the Eye. Now the viſual Triangle, whoſe Baſis is the Diameter of the Circle, and whoſe top is the Center of viſion, is proportioned to the Triangle, whoſe Baſis is the Diameter of the picture of the Circle on the bottom of the eye, and the top, the ſame center of ſight; the which center being diſtant 6 or 7 lines from the baſis of the optick nerve, whoſe breadth is about ¾ of a line, this baſis alſo will be about the *9th* or *10th* part of its diſtance from the Center of ſight, and by the Principles of Opticks, the Image of the circle of the white paper, falling on the baſis of the optick nerve, will cover it preciſely; and becauſe the Paper then wholly diſappears, it follows, that all the baſis of the Optick nerve is inſenſible of light; whence I conclude, that the *Choroeides* is the Principal Organ of ſight; and that the *Retina* is not, ſeeing it is placed in that part, and is there apparently diſpoſed in like manner as to the reſt of the bottom of the Eye.

To elude the force of this Argument, you alledge other cauſes of this fault of ſight; the two firſt are almoſt like one another. But it ſeems to me, that you ſuppoſe them without any ground: for, as I ſaid before, there are no ſuch filaments of nerves to be ſeen coming out of the baſis of the optick nerve; beſides, they are not proper for viſion, ſince they would leave in the parts of the Retina too great intervals empty; and its neceſſary, that every point of the Object find a ſenſible point in the Organ of ſight to unite his rayes there; which is found in the *Choroeides*, which is an Expanſion of the ſenſible part of the nerve into a continued membrane. Beſides, the cauſes of the defect of viſion cannot be found in theſe *Hypotheſes*; for in the firſt, what reaſon can be given, that there ſhould be no extremities of nerves oppoſite to the optick nerve. ſince there would need only a ſimple direct continuation of ſome of its fibers unto the Anteriour part of the Retina; and for the ſecond (which is the particular opinion) I ſee not, how the void ſpace in the middle of the inverted Tuft, can comprehend all that extent of the baſis whence it proceeds, and why the filaments begin not to receive the impreſſion of the luminous Rayes, but upon the Extremity of this baſis, ſince the rayes of a luminous point, which unite themſelves in a point at the bottom of the Eye, come from divers points of the Chryſtalline, and ſo, if one part of theſe rayes were oblique, the other ſhould be perpendicular, and if all the Rayes ſhould fall perpendicular on the Organ of ſight, there would be no viſion, ſince there is never but one ſingle Ray of thoſe which unite in a point, that falls perpendicular. But I ſhall not inlarge my ſelf to demonſtrate theſe impoſſibilities, ſince I am perſwaded, that theſe inverted tufts, and theſe filaments of which they are compoſed, are but things without a foundation, and which you would have much a doe to ſhew us.

The other Cauſe which you bring, is the trunk of the veſſels which proceed from the baſis of the nerve. Yet you cannot deny but they are very ſmall, and that it is very hard to diſcern the little holes through which they paſs, when the nerve is cut off above its inſertion into the Eye; and becauſe they often come out of the baſis by two ſeveral little holes, the diameter of each of which does not take up the ſpace of above the eighth part of the diameter of the baſis; it follows, that if the reſt of the nerve were ſenſible of light, we ſhould not looſe ſight of a paper of two inches diameter at moſt, at ten foot diſtance: and ſometimes in fixing one eye on a little piece of Paper, two other, very little ones, ſeparated one from the other, would diſappear; which is contrary to experience: for the default of viſion is continued. Seing than the reaſons which you alledg of this default of ſight are either inſufficient, or want an aſſured foundation, it follows, that that which I propoſe muſt ſtand, at leaſt, in reſpect of any thing you urge againſt it. And to confirme it yet more, I will adde here ſome reaſons and obſervations, which are neither in my letter nor in my writing.

The firſt obſervation which is very common, is that of the Pupilla dilates it ſelf in the ſhade, and contracts it ſelf in a great light, and it is very hard to find the cauſe of this unvoluntary motion, but by the Hypotheſis, that the *Choroeides* is ſenſible of light, for then it is eaſy to conceive that it being hurt by too ſtrong a viſion, it may dilate or contract its fibers, which have one continuity with thoſe of the forepatt of the *uvea*, ſo that it can contract its aperture, and when it is not hurt, relax it again: whereas if the Retina be ſuppoſed to be the Organ of ſight, it will be very difficult to explain how this contraction is made.

The ſecond is that of the glaſs bottle full of water, when a lighted candle is placed near its focus: for it is eaſy to prove that if one hold his hand between the Candle and the bottle, he will feel more heat than if he held it in the reciprocal Focus; that is to ſay, the place where the Rayes, which have paſſed thorough the bottle, make a great image of the flame of the Candle appear inverted upon a white ſurface oppoſed to it: for I draw this conſequence, that the Image of a Candle, which is painted on the *Choroeides* of a dog, as I have prov'd to you, makes a much greater impreſſion on the Retina of the dog, than on that of him that lookes on it and ſees it very bright; whence I conclude that if the Retina were the Organ of ſight, this dog would not ſee the objects indifferently inlightned, which are about the candle, although at 3 or 4 foot diſtance, becauſe they would receive a great deal more impreſſion from this reflexion, and that a great ſenſation doth obliterate a leſſer; which is contrary to experience, and it is not at all likely, there ſhould be ſuch a defect in the ſight of Animals.

The third is, that the Eyes of *Birds* are ſo framed, that the Optique nerve after its inſertion into the Eye is inflected, and extends it ſelf on the Concavity of the *Sclerotis* about the breadth of 2 or 3 lines more or leſs according to the bigneſs of the Eyes; and the length of this inflection is covered by the *Choroeides*, leaving but one little white ſtreak in the middle, from whence the *Retina* takes its Original, which extends it ſelf on the *Choroeides* through all the bottom of the Eye, but it is covered on the ſide of this white ſtreak with a little black membrane as long as the inflexion of the nerve, and almoſt as broad; which proceeds from the *pia mater*, and is as it were an appendix of the *Choroeides*: and if you conſider the ſituation of this membrane, you will find it is near the Axis of ſight, and that the rayes of the Objects, which the Birds look on with both Eyes, fall preciſely upon it after their refraction. Since then in the place, where Viſion ought to be ſtrongeſt, the *Retina* is covered, and that no man doubts but Birds are more clear-ſighted than other Animals; you ought to acknowledge, that the *Retina* is not the principal Organ of Viſion, but that that preeminence belongs to the *Choroeides*.

AN ACCOMPT

Given by Doctor Edward Brown, *concerning the Copper-mine at* Herrn-ground *in Hungary*.

HErrn-ground is a little town, ſeated very high between two Hills, upon a part of land of the ſame name, an Hungarian mile diſtant from *Newſol*. In this town is the entrance into a large Copper-mine, very much digged.

I went in through a *Cuniculus*, called *Tach-ſtoln*, and continued divers hours in the Mine, and viſited many of the moſt remarkable places in it. The ſteep deſcents in this Mine are made by Ladders or Trees ſet upright, with deep notches or ſtayers cut in them to ſtay the foot upon. They are not troubled with water, the Mine lying high in the hill, ſo that the water may drain away; but they are moleſted with duſt and damps.

The Veins of this Mine are large, many of them cumulate, and the Ore very rich; in an hundred pounds of Ore they ordinarily finde twenty pounds of Copper, ſometimes 30, 40, half Copper, and even to 60 in the hundred. Much of the Ore is joyn'd ſo faſt to the rock, that tis ſeparated with much difficulty. There are divers ſorts of Ore, but the chief difference is between the Yellow and the Black: the Yellow is pure Copper-ore: the Black contains alſo a proportion of Silver.

They find no *Quick-ſilver* here: the mother of the ore is yellow; and the Copper ore, heated and caſt into water, maketh it become like that of ſome Sulphureous Baths.

They ſeparate the Metal from the Ore with great difficulty. The Ore commonly paſſes 14 times through the furnaces: ſometimes it is burned, and other times melted; ſometimes by it ſelf, and ſometimes mixt with other minerals and its own droſs.

There are divers ſorts of *Vitreol* found in this Mine; Green, Blew, Reddiſh, and White. There is alſo a Green Earth or ſediment of a green water, called *Berg-grun*. There are likewiſe ſtones found of a beautiful green and blew colour, and one ſort, on which *Turcoiſes* have been found; therefore called the *Mother* of the *Turcois*.

There are alſo two Springs of a Vitriolat water, which are affirm'd to turn iron into Copper. They are called the Old and the New *Ziment*. Theſe Springs lye deep in the Mine. The Iron is ordinarily left in the Water 14 dayes. I here preſent you with ſome pieces of it, and with an Heart and a Chain, formerly Iron, now appearing to be Copper. Divers of theſe pieces I took out of the old *Ziment*. They are hard within the water, and do not totally looſe their figure, and fall into powder, as you will perceive by them; they will eaſily melt, I have ſent a piece melted without the addition of any other ſubſtance. They make handſome Cups and Veſſels out of this Salt of Copper: I drank out of one of them, when I was at the *Verwalter of Herngrownd* his houſe: It was gilded over, and had a rich piece of Silver-ore, faſtned in the middle of it, and this Inſcription grav'd on the outſide,

Eiſen ware Ich, kupfer bin Ich,
Silber trag Ich, Gold bedeckt mich.

i. e. Copper I am, but Iron was of old,
Silver I carry, cover'd am with Gold.

AN ACCOMPT

Concerning the Baths *of* Auſtria *and* Hungary; *as alſo ſome* Stone-Quarrries, Talcum rocks, &c. *in thoſe parts: By the ſame hand.*

IN order to anſwer ſome of the other *Queries*; I here preſent you with this Accompt concerning *Baths*, and ſome other ſubjects, contained therein.

Baden is a little City in *Auſtria,* four German miles Southward from *Vienna,* ſeated on a plain, but nigh unto a ridge of hills, which are the excurſions of Mount *Cetius.* It is much reſorted unto by reaſon of the Natural Baths of that place, wherein the Springs are ſo numerous, as to afford convenient Baths; two within the Town, five without the Wall, and 2 beyond a rivolet called *Swechet.*

The *Dukes-Bath* is the largeſt, about 20 feet ſquare, in the middle of an houſe of the ſame figure, built over it. The Vapour paſſes, through a tunnel of wood, at the top: and the Water is conveyed into the bottom of the Bath, at one corner, through woodden pipes and trees, under the Town-wall, from the Spring head, which riſeth at a little diſtance Weſt-ward. The Springs of the reſt of the Baths riſe under them, and are let in through holes of the Plancher, for all the Baths are wainſcoted, the ſeats, ſides and bottoms being made of Firre. The Water for the moſt part is clear and tranſparent, yet ſomewhat blewiſh, and maketh the skin appear pale in it, as doth the ſmoak of Brimſtone. It coloreth Metals (except Gold, whoſe colour it alſo heightens) turning them black in a few minutes. The Coyn of this Country, mixt of Copper and Silver,(having $\frac{7}{15}$ of Silver, and $\frac{8}{15}$ of Copper) is in a minutes time turn'd from a white into a dark yellow, and ſoon after becomes black. To the Moſs and Plants, which it waſheth, it gives a fine green colour, and leaves often a ſcum upon them of a Purple mixt with white. As it runs from the Spring-head, it ſomewhat reſembles the Sulphur-river in the way from *Tivoli* to *Rome*, but is not ſo ſtrong or ſtinking, nor doth it incruſtate its banks.

The Spring-head is alſo conſiderable, in regard that it riſeth under a rocky hill at ſome diſtance from the entrance into it: For, I paſſ'd to it, about the length of 40 yards, through an Arched paſſage cut in the rock, which is alſo a natural ſtove, (as that of *Tritola* and *Bajæ*) made by the hot Bath water running under it. Moſt part of this Cave is incruſtated with a white ſubſtance, by them called *Salt-Peter*, whereof I have ſent you ſome. At the mouth of the Cave it becomes harder and ſtony. I cauſed ſome of the pipes, through which the Bath-water runs, to be opened, and from the upper part of the pipe, I took ſome quantity of fine Sulphur in powder, ſomewhat like Flowers of Brimſtone; this being as 'twere, ſublimed from the water, and not depoſed, being found in the upper part of the pipe. *Oleum Sulph. per campanam* dropped into this water, is received into it quietly. *Oleum tart. per deliquium* cauſeth an ebullition, as in the making of *Tartarum Vitriolatum*.

The ſecond Bath within the Wall is that of our *Lady*, about 12 foot broad, and 24 long. One end of it is under a Church of the ſame name. This is fuller of Sulphur than the reſt, and more blew, and leaveth a yellow Flower upon the boards, as the others doe a white.

The third is the *New Bath*, out of the Town nigh the Gate; which when I ſaw was full of people ſinging.

The fourth, the *Jews Bath*, which hath a partition in the middle to ſeparate the men from the Women.

The fifth, St. *Johns Bath*, of a Triangular form.

The ſixth, the *Beggars Bath*, alwayes ſhallow, ſo as they ly down in it.

The ſeventh, the Bath of the *Holy-Croſs*, about two fathoms ſquare, chiefly for the Clergy.

The eighth, Saint *Peters Bath*, greener than the reſt.

The ninth, the *Sower Bath*, ſet about with Stone-balaſtres, and covered with an handſome Cupola and Lanthorn. The water is very clear; In the Steam of this Bath I have often colour'd mony black without touching the Water; and ſtaying only in the room, where the Bath is, the buttons of my clothes, and whatelſe of Silver the Vapour could come at, were colored yellow or guilded; and yet the water itſelf, once cold, changeth not the colour of Metals, though boyled in it.

The hotteſt of theſe Baths have not the heat of the *Queens Bath* at *Bath* in *England*. They uſe no Guides, as with us, but direct themſelves with a ſhort turn'd ſtaff.

Manners-dorff, ſeated under an Hill on the Eaſt-ſide of the river *Leyta* hath onely one Bath. It riſeth under a Church, built over the Spring-head. The water of it is luke-warm, and therefore they boyl it in great Coppers, when they deſire it hotter, and bath in Tubbs, fill'd with this boyled water. From the ſubſtance, which ſticks to the Coppers in boyling, it is collected, that it is impregnated with Sulphur, Salt-peter and Chalk. This water coloureth the ſtones in it of a fair green like a Turkois; and the Steam of it, which ſticks to the Moſs under the Church, turns into drops of Gold or Amber.

Dotis, 2 Hungarian miles from *Comora* in Hungary, famous for being watered with great numbers of Springs, hath alſo Sulphureous Baths, ſaid to be warm in Winter. I was there in *March* and *October*, and both times found their warmth very remiſs, ſcarce perceiveable. In colour they are blewiſh, and to taſte acid. The *Queens-bath* and the *Great-Bath* riſe in a Marſh, North-ward of the Caſtle. There is another Bath in the Governors garden within the Town. They are uſed as thoſe of *Manners-dorf*, by being boyl'd, and powr'd into Bathing tubbs.

At *Banka*, two Hungar. miles from *Freiſtat*, in a Meadow, I took notice of 15. Baths: And there have been more, but the river *Waag* eateth away the banks, and ſwallows up the Baths, and into three of theſe 15. it hath alſo broke in. The Water of theſe is like to that of *Baden* in *Auſtria*; it leaves a white Sediment upon the Moſs and places it waſheth, and tinctureth metals black: which I experimented by putting money into it; and ſticking ſome into the ground over which the water paſſeth, that part, which was in the ground, retained its own colour, and the other part in the Bath-water acquired a Coal-black. These Bathes are open, and very hot.

The Baths of *Boinitz* nigh the river *Nitra* in Hungary, are of a moderat gentle heat, delightful to bath in, much beautifi'd by Count *Palfi* Palatine of *Hungary*: And all of them covered under one large roof. The firſt is the Noblemens Bath, built of ſtone deſcended into on all ſides by ſtone-ſtayres. Four more there are of Wood, but very handſomly and well built.

At *Stub'n, 3* Hungarian miles from *Newſol* and 2 from *Chremnitz*, near to a rivolet, are divers Baths of great eſteem, and much frequented; the water whereof is clear, and ſmells of Sulphur; the ſediment green. It colours the wood over it green and black, but does not change the colour of metals ſo ſoon as moſt others. I left money in it a whole night, which was yet but faintly coloured. The Springs ariſe under-neath, and paſs thorough the holes in the plancher of the Baths. The heat thereof is anſwerable to the *Kings-Bath* in England. Theſe Baths are 7. The firſt, is the Nobleman's Bath. The ſecond, the Gentlemans. The third, the Country-mans. The fourth, the Country-womans. The fifth, the Beggars-bath. The ſixt, for ſuch as are infected with the *Lues Venerea*. The ſeventh, the Bath of the *Gypſies*; of whom there are many in thoſe parts. Theſe Baths are in a plain, encompaſſed on all ſides with hills. The nigheſt unto them are towards the Eaſt; and it is the ſame ridge of hills, which on the other ſide are ſo rich in Metals.

Glas-Hitten, an Hungarian mile, or about 7. Engliſh-miles from *Schemnitz*, hath five Baths; two of which are large. It depoſes a red ſediment, and incruſtates the wood and ſeates of the Bath under water with a ſtony ſubſtance; and it guildeth Silver. But the moſt remarkable of theſe Baths is that, which is called the *Sweating* Bath, whoſe hot Springs drain thorough an hill, and fall into a Bath, built to receive them; at one end of which, by aſcending, I went into a Cave, which is made a noble Stove by the heat of theſe *Thermæ*, and ſo order'd with

Seats, that every one who ſits in it, either by chuſing an higher or lower ſeat, may regulate his ſweating, or injoy what degree of heat he deſireth. This Cave, as alſo the ſides of the Bath, are covered, by the continual dropping of theſe hot ſprings, with a red, white and green ſubſtance: the red and green make the beſt ſhew, but the white is uſed againſt the Stone, and cureth Ulcers, and ſore backs of horſes

Eiſen-bach, about 4 Engliſh miles from *Glas-Hitten*, and 5 or 6. from *Schemniz*, hath alſo hot Baths; which I ſuppoſe are thoſe inquired after in your laſt Queſtion. Here are ſent you divers pieces of that ſediment and ſtone, taken out of theſe Baths; and one, which I took from the end of a Spout, through which theſe *Thermæ* had formerly paſſed. The wood ſtill ſticks to the bottom of it, but is not turned into ſtone (as you may ſee:) Yet I have ſeen great trees, plac'd at the top or ſuperficies of the water in the Bath, which have ſuffered petrifaction. Here are two convenient Baths, much frequented; and a third, which is made by the water let out of the former, called the *Snakes-bath*, from the number of Snakes coming into and delighting in it, when it is filled with theſe warm waters.

The natural Baths of *Buda* are eſteem'd the nobleſt of *Europe*, not only in reſpect of the large and hot ſprings, but the magnificence of ther Buildings. For the *Turks* bath very much, and, though little curious in moſt of their private houſes, yet are they very ſumptuous in their Publick Buildings, as their *Chans* or *Caravanſara's*, *Moſches*, *Bridges* and *Baths* declare.

There are 8 Baths, whereof I had opportunity to take notice during my ſtay at *Buda*; 3 towards the Eaſt and South-Eaſt-part of the City, in the way leading towards *Conſtantinople*; and 5, towards the Weſt-end of the Town in the way towards *Old Offen*, and *Strigonium*.

The firſt, is a large open Bath at the foot of an high rocky hill, formerly called *Purgatorium*, whereof the people have ſome odd and ſcruplous apprehenſions.

The ſecond is cover'd with a *Cupola*, and ſtands nigh the ſame Hill, but more into the Town, and near a place where they uſe Tanning.

The third is called the *Bath* of the *Green Pillars*, though at preſent they be of a red colour; and it ſtands over againſt the *Caravanſara.* The water is hot, but tolerable, without addition of cold water. It is impregnated with a Petrifying juyce, which diſcovers it ſelf on the ſides of the Bath upon the Spouts and other places, and maketh a gray ſtone: And the Exhalation from the Bath, reverberated by the Cupola, by the Irons extended from one Column to another, and by the Capitals of the Pillars, formeth long ſtones like Ice-icles, which hang to all the ſaid places; ſuch as may be obſerv'd in many ſubterraneous Grotto's, and particularly in *England* in *Okey-hole* in *Somerſet-ſhire*, and *Pooles-hole* in *Darby-ſhire*.

The water is let out at night, when the women have done bathing, who often ſtay late. The Bath is round ſet about with large Pillars ſupporting a Cupola, which hath openings to let out the ſteam thereof; and yet the whole room continues to be an hot ſtove.

The Baths of the Weſt-end of the Town are 1. *Tactalli* or the *Bath of the Table*; a ſmall Bath covered: the Water white, and of a Sulphureous ſmell. They drink of this as well as bath in it. What they drink, they receive from a Spout, bringing the Water into this place. I delivered a *five-ſols*-piece to a Turk, bathing in it, to guild for me, which he did in about a minute, by rubbing it between his fingers, while the hot water fell from the ſpout upon it.

2. *Barut Degrimene*, or the Bath of the *Powder-mill.* It riſes in an open pond near the high way, and mixeth with the freſh Springs, ſo that the pond is of a whitiſh colour in one part, and clear in the other, as alſo cold and hot in ſeveral parts. This conveyed croſs the high way into a Powder-mill, becomes uſeful in making of Gun-powder. They conceive here, that this Bath communicates with the Sulphureous Springs at *Dotis*, many miles diſtant.

3. *Cuzzoculige*, the little Bath or the Bath of the *Saint*; for which name the Turks give a ſuperſtitious reaſon. Tis kept by Turkiſh Monks. The Bath, where the Springs ariſe, is ſo hot as ſcarce to be endured; but being let out into another bathing place at ſome diſtance, it becomes tolerable and fit for uſe. This water hath neither colour, ſmell, nor taſte different from Common water, and depoſeth no ſediment; onely the ſides of the Bath are green, and have a fungous ſubſtance all over.

4. *Kaplih,* a very noble Bath, but part of the buildings was conſumed this year (1669) by a great fire which happn'd in *Buda*; but is by this time repaired by the Turks. The water is very hot, not without a petrifying juyce in it. The Building about is eight ſquare, with a noble Bath in the middle; with a circle of a Trench of water about it for the better ornament. On every ſide it has a *Nichio*, wherein is a fountain. In the middle of the Antichamber (where they leave their cloaths) there is alſo a fair Stone-baſon and a fountain.

5. The Bath of *Velibey*; which hath a ſtrong Sulphureous ſmell, and a pe-

petrifying juyce in it; and is ſo hot, that to make it tolerable, it requires the addition of cold water. This is the nobleſt Bath of any The Anti-chamber very large, the Bath-room capacious, and high-arched, and adorned with 5. Cupola's: one a very fair one, over the great round Bath in the middle; and one leſſer, over each of the 4 corners; where are either Baths or Bath-ſtoves for more private uſe: In theſe the Turks take off the hair of their Bodies by a *pſilothrum* mixt with ſoap; it being not their cuſtom, to have any hair, except on their beards, and a lock on the crown of their heads. Twelve Pillars ſupport the great *Cupola*, between 8 whereof are fountains of the hot water, and between the other are places to ſit down, where the Barbers and Bath-men attend. And each of theſe places have 2 ciſterns of free-ſtone, into which are let in hot Bath-water and alſo cold water, to be mixt and tempered as every one pleaſeth.

Men bathe in the morning, and *Women* in the afternoon. When any man intends to bathe, having entred the firſt rooms, he findes there divers ſervants attending, and furniſhing him with a cloth and apron. Then he puts off his apparel, and having put on the apron, he entreth the 2d room, wherein the great Bath is, and ſits on the ſide of the Bath, or between the Pillars nigh a fountain; where the Barber ſtrongly rubs him with his hand opened, ſtretching out his armes, and lifting them up; after which the party batheth. Then, if he be a ſubject of the *G. Signors*, or, it be the cuſtom of his Countrey, he hath his head ſhaved, and if a young man, his beard, except the upper-lip. Next, the Barber rubs his breaſt, back, arms and legs, with an hair-cloth; while he either ſitteth, or lyeth with his face downward; then waſhes his head with ſoap, and after throws cold water upon him all over his Body; and ſo the party walks about in the ſteam of the Bath for a time.

Theſe Baths are made uſe of two wayes, *either* by entring into the water, *or* ſitting about the Bath in the ſteam. For the vapour of the Bath makes the whole room a ſtove; and moſt ſweat as long as they ſtay in it; and ſome enter not the water at all, but have it powr'd upon them, or elſe only continue in the ſteam of the Bath; which ſufficiently provoketh ſweat.

So much of the Baths. Upon the ſide of Mount *Calenberg*, towards the North are Stones marked with Trees and Leaves. In the Hermitage of the *Camaldulenſes*, ſeated upon a Peak of this hill, I ſaw fair ones, with which they pav'd the walk in their Gardens. This place is 2 German miles from *Vienna*.

Not far from *Manners-dorf* is the Emperor's *Quarry of Stone*, out of which are made the beſt Buildings in *Vienna*: In which, where-ſoever there is a cleft or ſeparation of one ſtone from another, the water falling betwixt them, leaves a petrification, thereby, as 'twere, healing the wound, by making a ſtony *callus*, not exactly like the parts, which it joins together.

An Engliſh mile from *Freiſtat* in *Hungary* North-ward, is a Quarry of Stone, out of which many great Stones are digged, tranſparent aud reſembling Sugarcandy.

At *Banca*, two Hungar. miles from *Freiſtat* North-ward, is a Quarry of white ſtone, nigh the Hot Baths of that place; over which is a lay of Chalk of about a yard thick, very beautiful to the Eye, as being of all colors, except green; ſo finely mixt, ſtreaked, and ſhaded, that it ſurpaſſeth Marble-paper; and the water dropping upon it, doth as twere varniſh it.

At *Schemnitz* in Hungary, famous for Silver-Mines, is an high perpendicular Rock, part of which, from the top to the bottom, is naturally tinctur'd with a ſhining fair blew and green: And I have heard from a Spaniard, who liv'd long in the Weſt-Indies, that there is alſo a rock, like this nigh to the Silver-mines in *Peru*.

The Mountain of *Cliſſura*, being a part of Mount *Hæmus*, as alſo Mount *Pyrlipe* (both which I paſſed over travelling from *Belgrade* towards *Lariſſa* in *Theſſaly*) doe ſhine like Silver, and day and night, either by the light of the Sun or Moon, afford a glittering pleaſant ſhew, cauſed by the great quantity of *Muſcovy-glaſs*, wherewith theſe Hills abound. There are alſo *Talcum-rocks* nigh *Spitall* in upper *Carinthia*, as I have been informed by M. *Donellan*, who liveth there. I am unwilling to omit an Hill nigh *Sarvizza*, two dayes journey on this ſide *Lariſſa*, which conſiſts of an earth of a fine red colour, out of which the red Earthen Veſſels of that Country are made; as alſo the great number of *Acidulà* nigh *Tranſchin* in Hungary, there being 32 plentiful ſprings of them; likewiſe an Hot Bath nigh *Bellacherqua* in *Bulgaria*, it being ſcituated farr from any habitation, yet well built by the Turks, and very refreſhing to Travellours. It hath a red ſediment, and maketh a gray ſtone.

Being at *Lariſſa* in *Theſſaly*, where the *Gr. Segnor* hath long reſided; I underſtood, that he had paſſed a good part of the hot Summer of 1669. upon the neighbouring mount *Olympus*; and by the Interpreters to the Emperours Reſident, the *Illuſtriſſ*^{o} *Signor di Caſa nova*, (who were obliged to attend the *Sultan* upon the mountain) I was inform'd that there was a Spring of a whitiſh water upon that Hill, which was drank of by many perſons in their great heat and thirſt, contracted by aſcending the mountain, but proved very deſtructive unto them in 3 dayes, they then complaining of an heavineſs and coldneſs of their Stomacks till they dyed.

An Account of ſome Books.

There being lately fallen into our hands three Books written by ſeveral Authours, concerning the Production of the World, all three pretending to aſſert and confirm what is delivered by Moſes *in the firſt of* Geneſis, *though they do it different wayes; We thought, it would not be un-accep-*

table to the Ingenious, to give them here a taſte of theſe Treatiſes, thereby to excite them to a further diſquiſition and elucidation of this matter. We ſhall herein follow the order of the time, wherein theſe Books were publiſht; and therefore begin with

I. COSMOPOEIA DIVINA, ſeu Fabrica Mundi explicata, per *Ludov. de Beaufort* Pariſinum Med. Doct. *Lugd. Batav.* 1656. in 12°.

This Authour having in the *Dedication* of his Book profeſſed his averſion from deviſing any other Syſteme of the world, than that, which is deſcribed by *Moſes,* and having alſo expreſſed his labors and endeavours to adjuſt and accommodate all the *Phænomena* of Nature to the mind of that Divine Writer, tells us,

In his firſt Section, that God in the beginning of Time created, in a ſpace before void, *Heaven* and *Earth*, or the Matter of both, and of all things comprehended therein, as an unſhapen Maſſe, continued, un-divided, and un-moved: And that afterwards by his divine cheriſhing and ſeparating power he reſolved that dull and moveleſs matter into moving *waters*, or divided it into innumerable parts, and put it into motion by that diviſion, and by the introduction of a *vacuum*; by the means of which imparted motion, the particles began to extricate themſelves, to ſtirre, and to tend to their ſeveral places, and to afford the firſt Rudiments of three Ranks of great Bodies: ſo that, after the ſpace of 12. hours or thereabout, ſome *Light* began to appear, there being then ſo much of that ſubtile matter collected, as was ſufficient to illuminate a certain medium.

In the *ſecond* Section, that the Creator formed the *Firmament*, as a kind of Arched Vault in the *midſt of the Waters*, that is, more perfectly diſtinguiſht three Ranks or Material Principles of Bodies, *viz.* one in the middle, the *Firmament*, and two extreams, retaining the name of *Waters* but movable and moved: For, ſince on the firſt day all the parts began to be gather'd into three *Claſſes*, and the groſſeſt to take the loweſt place, the leſs groſs, the middlemoſt, and the fineſt, the uppermoſt, he conceiveth, that the Firmament was well ſaid to have been made this 2d day, foraſmuch as the Celeſtial matter was collected in the middle, and placed 'twixt the ſubtiler, whoſe place was above, and the thickeſt Elementary, being below: Which *waters* were ſimply ſo called before, as then actually conſtituting but one fluid body, but now diſtinguiſh'd into three ranks.

In the *third,* that the Creator began to ſubdivide the *third* rank, or the Elementary matter, (which was yet very Heterogeneous) by gathering together into one place all the Elementary Aqueous particles, which he call'd *Seas*; ſo that the *Dry* began to appear, which he called *Earth*; reſolving and raiſing upwards into vapors and exhalations the thinner particles, thence to produce *Air* and *Fire*; which are the four commonly ſo called Elements and reputed ſimple Bodies: out of which the other are compounded, firſt the imperfectly mix't, then gradually the more perfectly mixt, and after that the *Vegetative*, which about the end of this day began to be actually produced.

In the *fourth*, that he made the *Sun*, *Moon* and *Stars*, adorning and perfecting the Heavens. Where the Author thinks it no wonder, that theſe were not created before the fourth day, in regard there was required more time for the framing (without a new Miracle) ſo many and ſuch various *vortices*, thence to form the Heavens and the Stars, than for a ſimple ſeparation of the Water from the Earth.

In the *fifth*, that he produced Senſitive and Moving Creatures, of a lower order, *viz. Fiſh*, and *Fowle*.

In the *ſixth*, that he brought forth the other more perfect Animals, namely the *Beaſts of the Earth*; over which, as over all the reſt, the Great and Bountiful Creator ſet *Man*, whom he form'd after his own Image, endowing him with a Mind, and conſtituting him an *Epitome* of the Univerſe, and his Lievtenant General and Governour on Earth.

In all which the Author taketh notice of two Soverain Miraculous Works; *firſt*, the Production of the Matter of the World out of Nothing; the *ſecond*, the Diviſion and Motion cauſed in that Matter: declaring, that the other works may be conceiv'd to be produced without a new Miracle in the ſpace of the ſix dayes, enumerated by *Moſes*. Beſides, he takes occaſion, to explicate the nature of Motion, and to give the Laws of the ſame; to ſhew the neceſſity of a *Vacuum before* and *in* the Formation of the World; and *to* ſolve the Arguments alleadged againſt a *Vacuum*; In ſhort, *to* deliver his opinion, concerning all the main parts of Natural Philoſophy.

II. *CARTESIUS MOSAIZANS*, *Auth.* Joh. Amerpoel. *Leowardiæ* 1669. *in* 12°.

THe deſign of this Author is to make it out, that the Philoſophy delivered by the famous *Des-Chartes* doth well agree, at leaſt not diſagree with the Hiſtory of the Creation, recorded by *Moſes*. A deſign, which that Eminent Philoſopher entertained himſelf, and would have ſet upon, if Death had not prevented him, as appears in his Letters to *Merſennus*, *viz*. the 24th and 53d of the 2d *Tome*, where he affirms, that comparing his Principles with the Moſaick Hiſtory he had found, to his wonder, that the latter could be much better explicated according to the former, than by any other of all thoſe ways, wherein Interpreters have hitherto explain'd it.

To evince this, our Author hath taken the pains to make a parallel between the firſt Chapt. of *Geneſis*, and the Principles of *Des-Chartes*, endeavouring to make it appear.

1. That *Moſes* as well as *Des-Chartes* did acknowledg in the Corporeal Sphere of things nothing but one Homogeneous and Uniform *Matter*, divided and diverſify'd by *Motion*, put into that Matter by the Creator, and preſerv'd therein by the ſame.

2. That both begin their Philoſophy from the Conſideration of *Light*, as the firſt Effect of the Diſtinction of things from one another.

3. That both do attribute a *Fluidity* to the Heavens; yet ſo, as that *Des-Chartes* enlarges upon the *particular* Diſpoſition of the Conſtituent parts of that Body, which *Moſes* is ſilent of.

4. That the *Carteſian* Doctrine of the Diſtinction of the *Earth* from the *Waters* and *Air*, and of the proper Conſtitution of each of them, is not inconſiſtent with that of *Geneſis*.

5. That the growth and variety of *Vegetables*, and the cauſes thereof, aſſign'd by *Des-Chartes*, do not diſagree with the ſame Sacred Hiſtory.

6. That the *Carteſian* Doctrine of the Conſtitution and Uſe of the *Luminaries* and *Fix't Stars*, and their difference from the *Planets* and *Comets*; as alſo that of the *Motion* of the *Earth about the Sun*, and its own Axis, and the deflexion of its Axis from the Paralleliſme to the Axis of the Ecliptick, and the keeping in a perpetual Paralleliſme to itſelf, is very rational; and conſequently not incongruous to that of the Divine Philoſopher.

7. That there is a great agreement between *Moſes* and *Des-Cartes* in aſſigning the difference between the *Life* of *Beaſts*, and the *Soul* of *Man*; foraſmuch as both teach, that the *former* conſiſts in the *Bloud*; Which *Des-Chartes* further declaring, teacheth, That the Bloud heated in the Heart and ſubtilized into Spirits, is diffuſed from the Heart and Arteries through the Brain into the Nerves and Muſcles, and by a continual influx into the ſame, moves the whole and wonderfully contrived Frame of the Body and all the parts thereof; according to the various impulſes and actions of Objects upon them: But that the Soul of Man conſiſts in *Thinking* and *Underſtanding*, whereby principally Man reſembleth his Creator, to whoſe Image he is made. Which difference is confirm'd by what *Moſes* ſaith, that God commanded the *Earth* to bring forth *Living Creatures* or Beaſts, as well as he commanded the *Earth* to produce *Plants*; whereas, after he had formed Man out of the *Earth*, he is ſaid to have breath'd into him the *Breath of Life*, whereby Man became a Living *Soul*, not only *Living* and Moving, but a *Soul* too, that is, perceiving and knowing.

The third Book, promiſed in the Contents, we muſt refer to the next, for want of room.

ERRATA *left uncorrected in* No. 55. *Pag.* 1104. l. 21 *r.* one digits obſcuration. *p.* 1106. l. 22. *put out*, The Horizontal Parallax, *and read*, The Suns true place ♓ 17^{d}. 35^{m}. 47^{s}. | ♓ 17^{d}. 37^{m}. 51^{s}. *Betwixt this and the line preceding, inſert*, The Horizontal *Parallax* 53^{m}. 10s. *Pag* 1108. l. 19. *make the Parallax of Longitude in the ſecond Columne*, om 32^{s}; *and betwixt the* l. 21 *and* 22. *inſert*, with apparent South-latitude 4^{d}. 24^{m}. 59^{s}. | 4^{d} 28m 48s. l. 33 *and* 34 *read the* Subingreſs 16.43.3. Emerſion 18. 2.24. Pag. 1111. l. 15. *for* 52m. r. 52m. 52 $\frac{1}{2}$s. Pag. 1119. l. 3. *r.* about 28. inches.

London, Printed by *T. N.* ſor *J. Martyn* Printer to the R. *Society*. 1670.

Numb. 60.

PHILOSOPHICAL TRANSACTIONS.

June 20. 1670.

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A Letter of John Evelvn *Eſq; to the Lord Viſcount* Brouncker, *concerning the Spaniſh* Sembrador *or new Engin for Ploughing, Equal Sowing, and Harrowing, at once; together with a Deſcription of the Contrivance and Uſe of this Inſtrument. An Account of the Obſervation, made, a while ſince, by the Royal Academicians at* Paris, *of an* Halo *about the Sun; together with M.* Hugens *his Diſcourſe concerning the Cauſe of thoſe Meteors, as alſo that of the* Mock-Suns. *A Diſcourſe of Dr.* Rob. Wittie, *about Mineral Waters, and Extracts made out of them. An Accompt of ſome Books.* I. *The DIVINE HISTORY of the GENESIS of the World,* (promiſed in the Contents of the precedent Tract, but not then inſerted, for want of room.) II. *FRANC. TRAVAGINI Super Obſervationibus aliquorum Terra-motuum PHYSICA DISQUISITIO.* III. *QUÆSTIO TRIPLEX de ANNO, MENSE & DIE CHRISTI NATI BAPTISATI & MORTUI, Auth:* Mich. Seneſchallo *è S. Jeſu.* IV. *HERMANNI GRUBE M. D. Commentarius de modo ſimplicium Medicamentorum facultates cognoſcendi. V. De LACTE LUNÆ Diſſertatio Medica,* Joh. Danielis Majoris.

A Letter of John Evelyn *Eſq;, to the Right Honourable the Lord Viſcount* Brouncker, *Chancellor to her Majeſty and Preſident to the* R. Society *&c. Concerning the Spaniſh* Sembrador *or New Engin for Ploughing, and Equal Sowing all* *ſorts of Grain, and Harrowing, at once; By which a great quantity of Seed-corn is ſav'd, and a rich increaſe yearly gained; together with a Deſcription of the Contrivance and Uſes of this Engin, Engliſh't out of* Spaniſh, *and lately preſented to the* R. Society.

My LORD,

I Cannot deviſe better how to expreſs my great reſpects to your Lordſhip, than by my utmoſt endeavors to promote the Intereſt of that *Society*, over which you have ſo long, with ſo much ability and affection, and ſo faithfully Preſided. *This* therefore will plead my excuſe with your Lordſhip, if in ſome confidence of gratifying the generous deſignes of that Noble Aſſembly, I communicate to them, through your hands, not only the *Inſtrument*, (which I herewith preſent them) but the Deſcription of the *Uſe* and *Benefit* of it from ſuch a *Deferent*, as I am ſure they will very highly value. My Lord, it is now almoſt two years ſince, that (by ſomewhat an odd accident) lighting upon a paper lately printed in *Spaniſh*, I found a ſhort paſſage in it, giving notice of a certain *Plough* newly brought out of *Germany* into *Spain*; in both which places it had (upon *Tryal*) ſo generally obtain'd, as (beſides the *Royal Priviledg*, which was granted to the Inventor) to procure the Univerſal Approbation. Upon this hint, I took the boldneſs to write to My Lord Ambaſſador, intreating his Excelly, that, as his more weighty affairs would give him leave, he would not diſdain to inform himſelf more particularly concerning it. *This* his Lordſhip was not only pleas'd to do, but ſo highly obliging, as to tranſmit to me the Engin it ſelf, together with a full Deſcription of it, and its uſe: All of it written with his own noble Hand, which I do here conſecrate to the R. Society, to be inſerted among their precious *Cimelia*.

My Lord, being not ſo happy, as to wait on you my ſelf with it at your publick Aſſembly this day, I deſire, your Lordſhip will cauſe theſe Papers to be read there, and expoſe the Inſtrument to their Examination and Tryal. There are many

Gentlemen, who will not be offended with theſe *Ruſticities*, and who know, how highly ſuch *Inventions*, and even *Attempts* have been valued by the greateſt and the beſt of Men. Something (tis poſſible) may happen to be out of order, by reaſon of the long Journey it hath paſſed; but their Ingenious *Curator* will ſoon be able to reform, and, if need be, improve it. My Lord of *Sandwich* is that Illuſtrious Perſon, to whom the *Society* is obliged for this, and many other Favors, and Productions of his own more conſummate *Genius*, which enrich their Regiſters. But, let me tell them, his Lordſhip hath made, and brought home with him, ſuch other polite Notices and Particulars of *Spain*, and other Forrain Parts, as I know no Perſon of the moſt refin'd and publick Spirit, who hath approached him, beſides your Lordſhip: An Emulons and Worthy Example certainly to the reſt of our *Noblemen*, and *Miniſters* of *State* abroad, who may travel with ſo many Advantages to inform themſelves above Others: And it is to me a ſhining Inſtance of both your Lordſhips happy *Talents*, and great *Comprehenſion*, that in the throng of ſo many and ſo weighty Employments, you can think of Cultivating the *Arts*, and of doubly obliging your Country. How do ſuch *Perſons* enamel their *Characters*, and adorne their *Titles* with laſting and permanent honors! This Teſtimony of my Juſt Veneration to both your Lordſhips I could not, upon this Occaſion, but ſuperadd, who am

Says-Court My Lord
23. *Febr.* 16$\frac{69}{70}$. *Your Lordſhips moſt humble, moſt devoted*
and moſt obedient Servant

J. Evelyn.

Follows now the Extract of the Deſcription of this Sembrador, *publiſh't by Don* Joſeph Lucatelo *Knight, of the Province of* Carinthia, *a Subject of the* Houſe of Auſtria, *Inventor of the Engin, Dedicated to Signor Don* Geronimo de Camargo, *Councellor of the* Conſejo Real de Caſtilla, *and of the* Hazienda Real, *and by Commiſſion of his Catholick Majeſty made Judge* Protector *and* Conſervador, *for the better Diſtribution, and Direction of the uſe of the ſaid Inſtrument.*

After the *Inventor* had in the Dedication appeal'd to Don *Geronimo de Camargo* as an Experimental Judge and Eye-witneſs of the Performances of this Inſtrument, and taken occaſion to celebrate the happineſs of the latter Ages upon the account of the *Inventions* of many Excellent things, as the Uſe of the Loadſtone; Gun-powder; Great Ordinance; Printing; the Ordering of Quickſilver to ſeparate the nobler from the baſer Metals; the Perfecting of Watches by Pendulums; and many more: After this, I ſay, it is repreſented,

Firſt, That both the Ancient and Modern Husbandmen have agreed, that the Perfection of Agriculture conſiſted in ſetting the Plants in proportionable ſpaces, and giving ſufficient depth to the Roots, that they may ſpread enough, to receive that nouriſhment from the ground, which is neceſſary to produce and ripen the fruit: For which reaſon we ſee, that Plants are ſet in rowes by rule and meaſure, as the Vine, Olive-trees, and other Fruit-Trees; and in Gardens, the Herbs, and Flowres are planted and ſow'd with ſome order and diſtinction, ſo that their over-nearneſs and the confuſion of their Plantation may not hinder their growth.

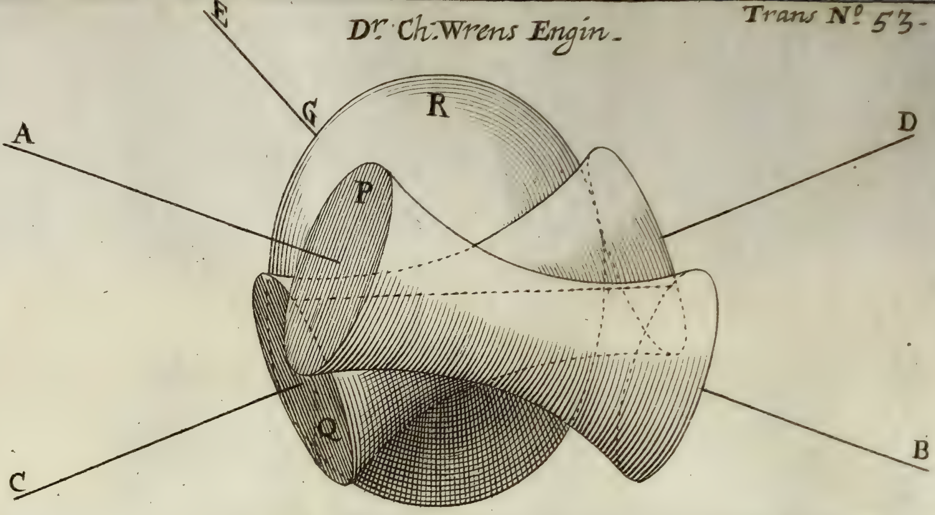
Secondly, That care hath not been had in the practice of this important part of Husbandry, ſince even at this day all ſorts of Seeds, of Corn and Grain, are ſown by handfuls, throwing them out by aime, heedleſly and by chance (counting it too tedious and chargeable to ſet them one by one in large fields;) whence we ſee Corn ſow'd in ſome places too thick, in others too thin, and the greater part of it not cover'd, nor deep enough, whereby it is not only expos'd to be eaten by Birds, but alſo, in Cold Countrys, to be ſpoyled by Froſt, and in Hot Regions, by the Sun.

Thirdly, That, upon theſe Conſiderations, He (D. *Joſeph de Lucatello*) hath, ſome years ſince, given himſelf to invent an Inſtrument, which with great eaſe, and with litle charge or trouble, ſets grain in order and proportion, for the ſparing a great quantity of Seed-corn, and enriching the Crop: And that after much Experience he hath perfected and reduced unto practice thoſe *idea*'s, producing an Inſtrument, which being faſtn'd to the Plough, at once Ploughes, Soweth, and

BRITISH MUSEUM
NATURAL HISTORY.

Trans No. 53.

Dr. Ch. Wrens Engin.



For ye Salt-work.

Fig. I.

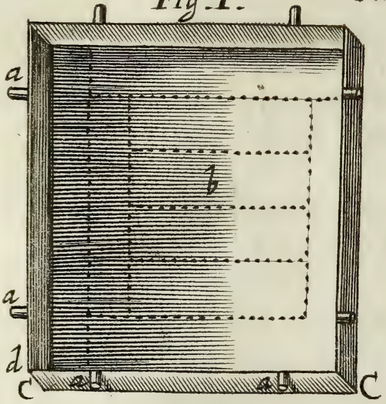


Fig. III.

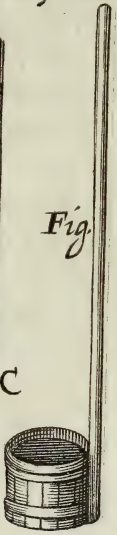


Fig. IV.

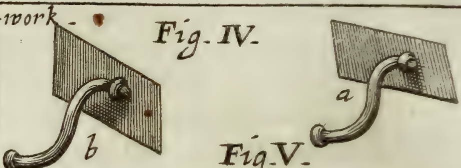


Fig. V.

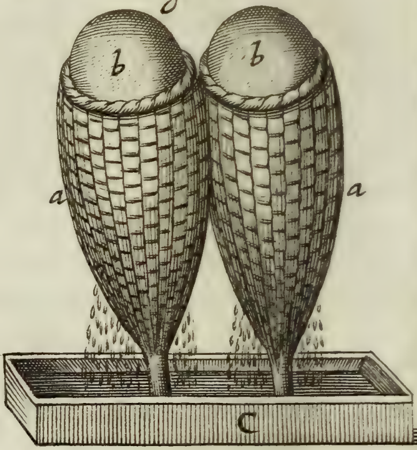


Fig. VI.

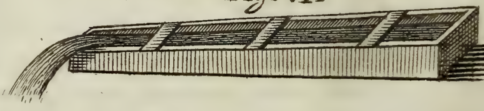
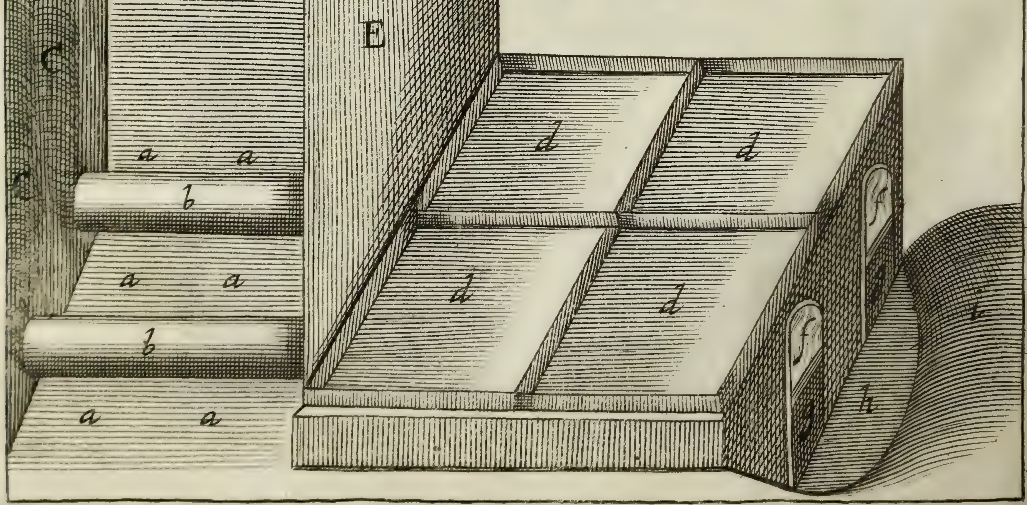


Fig. II.



Harrows, whereby is ſaved the labor of the Seeds-man, and the grain falling in order, and in the bottom of the furrow, all of it remains in one and the ſame diſtance under ground, ſo that of five parts of ſeed, four parts are ſaved, and then in the Crop is gain'd incredible abundance.

Thirdly, That the Inventor having obtain'd a thing ſo beneficial to Mankind, thought it reaſonable to communicate it to the World under the Patronage of one of its Greateſt Monarchs; and ſo preſented it at the feet of his *Catholick Majeſty*, who received the Propoſition, and cauſed trial to be made thereof in the *Buen Retiro*, where it did anſwer expectation, notwithſtanding the drought of the year, then much damnifying all Corn; an ordinary Husbandman from a meaſur'd ſpace of ground there, ſow'd in the common manner, reaping 5|125; where he, by his contrivance, from an equal ſpace of ground there alſo, reaped 8|175; beſides the ſeed ſaved in the ſowing.

Fourthly, That thereupon his ſaid *Catholiek Majeſty* did grant to the Inventor the Priviledge, That he only and his Aſſignes may make and diſtribute theſe Inſtruments in all the Kingdoms and Provinces of that Monarchy *in Europe*, at the price of 24 *Rials Plate*, each, and *out of Europe*, 32 *Rials Plate*; of which the fifth part ſhould be paid to the King; prohibiting alſo to all, that have not the leave of the Inventor or of perſons authoriſed by him, the making of this Inſtrument, under the penalty of 1000 *Eſcud. d'oro*, to thoſe that are able to pay it, and to others, that are unable, other puniſhment equivalent thereunto: And not only thoſe, that make it, but ſuch alſo, as buy and uſe it, are lyable to the ſame penalties, which are to be divided into three parts, $\frac{1}{3}$ to the *Camera*, $\frac{1}{3}$ to the Judge, and $\frac{1}{3}$ to the Informer.

Fifthly, That for the better Execution hereof, and proviſion in all Caſes that may happen for the introduction and Conſervation of this Inſtrument, his Catholick Majeſty hath nominated *D. Geronimo de Camargo*, for Judge *Conſervador*, with full power to depute ſuch perſons, as he ſhall think fit, within and without *Spain*, for the exerciſe of his Authority, and for receiving his Majeſties due upon this Licence.

Sixthly, That before the *Inventor* came to the Court of *Spain*, he made divers Tryals in his own Country, wherein he ſucceeded according to wiſh; and thereupon made the great tryal of this Engin before his preſent Imperial Majeſty, in the fields of *Luxembourg* in *Auſtria*, where the land uſually yields four or five fold; but the Crop from the ground ſow'd with this Inſtrument was *ſixty* fold, as appears by a Certificate given in *Vienna Aug.* 1. 1663. ſt. n. by an Officer of the Emperor, appointed to ſee the ſaid ground ſowed and reaped: which Certificate was thought needleſs to inſert here *verbatim.*

Seventhly, That this Priviledge being diſpatch't and the Seedtime then approaching, he (the *Inventor*) forthwith publiſht his Contrivance, and Inſtructions, as follows;

1. There is a Box of Wood, having a Cylinder or Roler paſſing at each end into two wheels, ſet about with ſtrong nails, and divided into three equal parts, ſurrounded upon the lines of diviſion with litle Bras-ſpoons. equally diſtant from one another, ſo as each of them in one row is poſited over againſt the middle of the oppoſite interſtice of the other row; which Spoons in the turning of the Inſtrument take up, each, one ſingle grain at a time, and throw it out at certain holes, into the ploughed ground. The parts of it are theſe: In the firſt *Plate*, repreſenting this *Sembrador*, *Fig* I. ſhows the Intire *Box* without the Wheels; *a b c d* the cover of that part, where the Corn is put in, which is open in *Fig.* I. at W. And *e f h g k l.* the two ſides which cover that part of the Box, where the Cylinder, which is ſtuck round with three rows of litle ſpoons, is moved about to throw out the Corn; which ſides are taken off in *Fig.* 2. to make the Cylinder RS with the Spoons *x x x* appear: the inner ſhape of which ſides is expreſs'd in *Fig.* 3; where may be ſeeen the four Triangular pieces *p p p p*, leaving Triangular interſtices *q q*, which ſerve to conveigh the Corn carryed up in the Spoons, and diſcharged at the top of the Cylinder, ſo as they may juſt run out at the holes underneath the Box, the parts of which anſwer to the parts of the firſt *Figure* according to the letter. T. is one of the Wheels; V, the other end of the Cylinder, upon which the other wheel is to be placed.

2. This *Sembrador* muſt be tyed faſt to the Plough, in the

manner as is ſeen in *Fig.* 4; ſo that the Corn may fall in the furrow, and, at the turning of the Plough, the Ears of the Plough may cover the Corn of the laſt furrow with earth.

3. Becauſe the Seed ſow'd by this *Inſtrument*, is plac'd in a convenient depth, *viz.* in the bottom of the furrow, whereas the ſeed ſcattered the comon way remains nearer the ſuperficies of the Earth, or quite uncovered, therefore it muſt needs ſhoot forth ſomewhat later; ſo that it is requiſite, the Husbandman, uſing this Inſtrument, ſhould ſow 8 or 10 days ſooner than the accuſtom'd Seed-time (that the Corn may ſprout forth on the face of the Earth in convenient time) and make an end of ſowing with the ſame as many days before others; *viz.* beginning to ſow in the midle of *September*, and making an end at the midle of *November*.

4. In ſtiff ground the furrows ought to be 5 or 6 inches deep; in middle ſort of ground, 6 or 7; and in light and ſandy ground, 7 or 8 inches; and according to this proportion the husbandman muſt govern himſelf deepning or ſhowling the Plough, as the condition of the land ſhall require.

5. Eſpecial care muſt be had, that the Wheels of the ſide of the Inſtrument do always turne round, and never drag along without turning; as alſo, that the Ears of the Plough be made ſomewhat bigger then the ordinary ones.

6. 'Tis alſo convenient, that the Seed be well ſifted and clean'd, that ſo the litle Spoons may every time take up a grain, and the Seed be the better diſtributed.

7. In *Barley* 'tis to be well obſerved, that it be made clean in that manner that the ſtraw and beards be broken off as near the grain as may be, that ſo they hinder not the iſſuing of the grain out of the Inſtrument.

8. After Seeds-time done, furrows muſt be made to drain the land of water, according to the uſe of each Country, without doing any thing more extraordinary, until the Harveſt.

This Inſtrument and theſe Inſtructions being thus made publick, many perſons, expecting great benefit from it in Husbandry, came to *Madrid* A. 1664. to buy this Inſtrument at the price of three *Rials of* 8. *Plate*; which then ſeemed a rate proportionable for the charge of making the Inſtrument, and the

Inventors gain. And ſo they made tryal in many parts of *Spain*, where they found the truth of what was promiſed by the Inventor, and diſcovered no other defect of the Inſtrument, than the ſlightneſs thereof, and its not being durable enough. To remedy which inconvenience, *Don Geronimo de Gamargo* was perſonally to view ſome grounds near *Madrid* ſowed by this Inſtrument, the better to inform his Majeſty of the Condition and ſucceſs of them, and how it was neceſſary ſomewhat to increaſe the price of the Inſtrument, that it might be made ſtronger and more durable. And His Majeſty was pleaſed to add one piece of 8. to the former price; whereby the Inſtrument is notably improved and bettered; the little Spoons, which at firſt were of Tin, are now of Braſs, and bigger than before, and more in number: The Wheels alſo are made bigger, and more ſubſtantial, and the Iron-plates likewiſe, together with the Nails of the Wheels, and Clouts of Iron and Rings of Braſs, to ſave the Axel-trees from wearing.

And that the Husbandman may the more underſtandingly uſe hereafter this *Sembrador*, and with greater eaſe, here are added more large *Inſtructions* than thoſe, that were publiſht the laſt year.

Larger Inſtructions for the Uſe of the New Sembrador.

1. Before they ſow the ground, they muſt give it ſo many tilths as is accuſtomed in that Country where the Land lyeth; concerning which tis needleſs to enlarge, ſince every ploughman knows it to be one of the fundamental rules for having a good Crop, to plough the ground three or four times, thereby to reduce the Land into mould, to kill and pluck out the weeds, and to break the clods.

2. When they go about to ſow, the Ploughman muſt begin to open a furrow with the Plough for one or two paces, and when the Plough is well in the ground in a convenient depth, then they muſt tye the *Sembrador* to the Plough-beam (as was mentioned above in the ſhorter Inſtructions,) ſo that the wheels and the nails in them ſtand upon the ground, and the bindings of the rings muſt be very hard, and in the manner expreſſed in the *Picture*: So ſhall the wheels move always, and the Inſtrumennt not reel, but move equally, whereby it will ſow with

better order and proportion: And this very ſtrong tying it to the Plough, ſo that it may not wreſt any way, will alſo make it ſow with the ſame order and equality over Hills, as alſo over rough uneven grounds, as over the ſmootheſt.

3. The Ears of the Plough are to be made larger, than hitherto; whence two advantages will ariſe: 1. It will better cover the furrows when ſown; and make wider furrows to receive the ſeed, when they do ſow. 2. Thoſe larger Ears will prevent the blows, the great Clods and Stones will give the *Sembrador* (if the Clods be not broken, and the Stones pick't out.) But when there are ſuch great Stones in the Land, as the Plough cannot penetrate; then the Plough-man by lifting up his plough muſt paſs over it, until he meets with mould again; and ſo muſt the *Sembrador* alſo be lifted up, the weight thereof being but very little, and no conſiderable trouble to the Plough-man.

4. When the Clodds and Stones cannot be maſter'd with only one pair of Ears, you muſt add another pair of them to the Plough, four or five inches higher than the firſt (chuſing a fit place in the beam to place them in,) although behind the others a little; for ſo the *Sembrador* will be perfectly ſaved and defended: And the ſecond Ears are to be of the ſame bigneſs with the firſt. And this is found by Experience to be the beſt remedy againſt the Stones and Clodds.

5. The Time of Sowing, according to the moſt experienced Farmers, is, when the mould of the Land is dry, or but a little inclining to moiſture: In either of which conditions of the Land, this new *Sembrador* works without clogging the wheels, or ſtopping up with dirt thoſe holes, through which the grain is to iſſue forth. And to ſow land, when 'tis dirty and full of water, is very hurtful to the Farmer, who then looſes his Seed, and the pains of tilling, and the Crop. And this *Sembrador* may ſerve for a means to try, *when* the Land is in good temper to be ſown, *viz.* when the wheels of the Inſtrument will move equally, and without hindrance or clogging with dirt. And when the wheels will not turn round becauſe of the clay and over-much moiſture, it is a ſigne, that 'tis not fit for cultivation, until it ungive and be dry.

6. When 'tis time to ſow, the Corn muſt be very well clean'd, and eſpecially the Barley, as was noted in the former Inſtructions.

7. To know, when this *Sembrador* works beſt and moſt equally, you are to obſerve the quantity of Seed it ſows upon an *Hanega* * or half an *Hanega* of Land: for if it work as it ought to do, it will ſow three *Celamines* of Wheat (a little more or leſs) and five *Celamines* of Barley in every *Hanega* of Land. And if it much exceed or fall of this proportion, it noteth ſome fault in the Inſtrument, or careleſneſs in the Plough-man; which is very eaſy to diſcover, eſpecially from any impediment in the wheels, which ought always to turn round, and not to drag, becauſe upon their motion the Sowing wholly depends; and without it there will not one grain be ſowen.

* Hanega *is as much Land, (by the information of Inquiſitive Travellors in* Spain) *as will take about* $1\frac{1}{2}$ *buſhel of Engliſh meaſure, after the common way of ſowing.*

A Celamine *is about* $\frac{1}{12}$ *part of an Engliſh buſhel.*

And this care and obſervation muſt be in all other Seeds, proportionably to their bigneſs; noting that for the bigger ſort of Seeds, ſuch as are *Garavancas* (or Rounſifals) *Lupins* and other ſuch like, there muſt be *Sembradors* made with bigger Spoons; as there are to be made others with leſſer Spoons for the ſowing of *Rye, Millet*, and other leſſer Seeds.

8. How to manage the *Plough* in ſtiff or light ground, was noted in No. 3. of the former *Inſtructions.*

9. When you ſow, you muſt plough the furrows very cloſe one to another, that ſo the Plough, when it turns back, may the better cover the laſt furrow, which is left open, and ſow'd as it came along.

10. The Plough-beam and Plough-tail are to be governed ſtraight, without wrinching any way, that ſo the *Sembrador* may follow ſtraight, and without going awry, and ſow the grain in better order.

11. After having ſown the Land in the ſaid manner, the Land ſhould be made as plain as can be, and no ſuch furrows made to carry away the water, as hitherto hath been uſed; but it will be ſufficient, that at every four yards diſtance (one from the

other) ſurrows be made: For, Experience hath taught us, that the Land laid up without furrows bears more Corn, than that which hath more furrows; becauſe the Wheat and Barley, and other Plants receive greateſt damage by drought: And therefore this ought more eſpecially to be obſerved in *Spain*, one of the dryeſt Country of *Europe*.

12. In many parts of *Spain* in *1664*. it was found, that Land ſown in *September* hath yielded a better Crop, then that which was ſow'd in *October*; and that ſown in *October*, better than that ſown in *November*: Which proveth, that 'tis more advantagious to ſow early, then late.

13. They have obſerv'd alſo, That it is very profitable to ſow in the *New Moon*, becauſe it will ſhoot forth, and thrive, and ripen ſooner. This is underſtood for thoſe, who till but a little Land, and ſo can chuſe their own time to ſow; but thoſe that plough great quantities, can loſe no time nor ſeaſon in ſowing. And in *Spain* they may begin the firſt *New Moon* in *September*, and ſo go on, and end with the *New Moon* in *November*. And in *Italy* they may do in the ſame manner, as alſo in the Iſlands of the *Mediterranean*. But in *Germany* and the *Low Countries*, they begin in the end of *Auguſt*, and end with the *New Moon* of *October*.

So far this Account. If any deſire to ſee this *Inſtrument*, he may inquire for the *Curator* of the *R. Society* (Mr. Hook,) or for their *Operator* Mr. *Shortgrave*, in *Greſham Colledg*, *the latter of whom will alſo, in all likelyhood, be ready to provide the Engin itſelf for thoſe, who ſhall pleaſe to make uſe of it.*

An Account of the Obſervation, made by the Philoſophical Academy at Paris, May 12 1667 *about 9. of the Clock in the morning, of an* Halo *or Circle about the Sun; together with a Diſcourſe of M.* Hugens de Zulechem, *concerning the Cauſe of theſe Meteors, as alſo that of* Parelia's *or Mock-Suns. Engliſhed out of* French *by the Publiſher, to whom it was ſent but lately from the worthy Author of the ſaid Diſcourſe.*

THe Diameter of this Circle, which was exactly obſerv'd, was found to be of 44 degrees, and the breadth of the Limb thereof, of about half a degree. The upper and lower part were of a vivid red and Jellow, with a little purple-colour

lour, but eſpecially the upper; the red was within the Circle. The other parts appeared but whitiſh and of little clearneſs. The ſpace within the *Halo* was a little darker then that about it, eſpecially towards the parts that were coloured. Beſides there was ſeen the portion of another great Circle, which touched the *Halo* above, and whoſe extremities were bent downward, as is repreſented in the I. *Fig.* in Tab. 2. This portion of a Circle had alſo its Colours like thoſe of the *Halo*, but fainter. The height of the Sun, at the beginning of the Obſervation, was about 46. degrees. There were in the Air little white Clouds, which ſomewhat tarniſh'd the blew colour of the Heavens, and leſſened the brightneſs of the Sun, which ſhone as in an Eclipſe. The weather was cold, conſidering the ſeaſon of the year, and it was affirmed for certain, that it had frozen the night before. This *Halo* appeared in the ſame beauty and ſplendor of colours, unchanged, from 9. in the morning, (when it began to be obſerved) until about half an hour paſt ten; after which time it became fainter and fainter till two of the clock in the afternoon, when it ended, after it had reſumed a little more force ſome time before it diſappeared.

The Obſervation of this *Phænomenon* engaged M. *Hugens* to propoſe to the Company, aſſembled at his Majeſties Library, what he had meditated, ſome years agoe, concerning the Cauſe, not only of theſe *Halo's*, but alſo of the *Parhelia*, which have been hitherto look't upon by many as Prodigies, and as Prognoſticks of ſome ſingular Event.

As for the *Halo's*, he ſaid, that they were formed by ſmall round grains, made up of two parts, one tranſparent, the other opaque, the latter being incloſed in the former, as a cherryſtone is in a cherry; as may be ſeen in the II Figure, wherein A A repreſents one of theſe grains, and B the kernel or opaque part (*'Tis drawn much bigger than the natural, to render the thing the more intelligible.*)

He related the Obſervations of thoſe who have ſeen *Hail* formed after this manner, and, among others, that of M. *Des-Cartes* in his Treatiſe of Meteors; and explain'd, how that ſome of theſe little grains, which ſwim up and down in the Air betwixt us and the Sun, being leſs diſtant from the *axis*, which extends itſelf from the Sun to our Eye, than of a certain angle, do neceſſarily hinder the rays, which fall on them, from coming to our Eyes, in regard that the opaque kernel is the cauſe that there is behind every ſuch grain a ſpace of a conical figure, as M N O in the II. Figure, in which the Eye of the Spectator being ſcituated cannot ſee the Sun through that grain, though it may ſee him when poſited elſewhere, as ſomewhere in P.

And to make the Company the more diſtinctly to underſtand the effect, which theſe Grains ſuſpended in the Air muſt produce, he drew the III Figure; in which, B is the place of the Eye; B A, the axis which paſſeth from the Eye to the Sun; C, M, F, ſome of the icy Grains with their kernel, making them half opaque: Among which, the Grain C, being in the *axis* B A, and the lines C K, L H, repreſenting the rays of the Sun neareſt to the *axis*, the paſſage of which is not hindred by the opacity of the kernel, 'tis certain, not only that the grain C will not be able to tranſmit any ray of the Sun towards B, but alſo that, imagining the ſuperficies of a Cone, whoſe top is in the Eye, and its ſides B D, B E, parallel to the rays C K, L H; all the grains M M, which this ſuperficies ſhall compriſe, will likewiſe not ſuffer any ray to paſs to the Eye, becauſe it muſt needs be in their Cone of obſcurity; but thoſe, that ſhall be without this ſuperficies, as the grains F F, will let them paſs, becauſe the Eye is without their Cone of obſcurity. Whence it follows, that the Angle of this Cone B D E is that, which determins the Diameter of the *Halo*, which depends from the proportion, the opaque grain hath to the tranſparent, in which it is incloſed. For, if this Diameter is of 44 degrees, as is obſerved in moſt *Halo*'s, the bigneſs of the opaque grain will be to the tranſparent as 40 to 19. But he ſaid, that this proportion was not always the ſame, and that the diverſity of it was the cauſe, that ſometimes there were ſeen many *Halo*'s, one about the other, all having the Sun for their Center.

He added, that it was eaſy to know, why theſe *Halo*'s were always of a round figure, whether the Sun be little or much raiſed above the Horizon; as alſo to give a reaſon of their Colours, which is the ſame with that in the Triangular Glaſs-

Priſmes; as is evident by the *Tangents* A D, drawn to the Grain A, at the points, where the Ray D A enters or coms out.

Further he took notice, that it was alſo manifeſt, why the *red* colour is in the interiour circumference of the *Halo.* And why the ſpace, which it taketh in, and chiefly near the moſt lively colour'd parts, appears obſcurer than the Air about; *viz.* becauſe 'tis there, where *moſt* Grains are, which tranſmit no rays of the Sun to our Eyes, and ſo do nothing but darken the Air, as the drops of water when it raineth.

Moreover he noted, that M. *Des Cartes*, endeavouring to explain the Cauſe of theſe *Halo*'s, had committed a miſtake, for want of Obſervations, truly relating this laſt circumſtance: Becauſe he maintains, that the ſpace compriſed within the *Halo* is clearer than the Air without; and to render a reaſon of it, he ſuppoſeth certain Grains, *altogether* tranſparent, having the form of a lentil; which ſuppoſition cannot therefore be true, becauſe what he deduceth from it, is contrary to what is obſerved: Beſides that the roundneſs of the *Halo* in all the elevations of the Sun agreeth not with it, as were eaſy to ſhow.

He ſtayed not to examine the Generation of the half-dark grains, becauſe he is ſhortly to publiſh a larger Treatiſe of this ſubject; where he intends alſo to render a reaſon, why the dark kernel keeps certain proportions, rather than others, with the Grain, which contains it.

As to the Arch of the Circle, which above touched the laſt *Halo* ſeen *May* 12th, as alſo that the Colours were more vivid in this place, and in that below, then in the reſt of the Circle; he ſaid, that theſe effects did not proceed from the Grains, he had been ſpeaking of, but from another cauſe, which did alſo ſerve for the production of the *Parhelia* and the *Circles* which almoſt always accompany them.

Touching which *Circles* and *Parhelia*'s he told the Company, that beſides the round and half-dark Grains, there were alſo formed in the Air certain little Cylinders of the like nature, and of which M. *Des Cartes* himſelf declared in his *Treatiſe of Meteors* to have obſerved ſome, not indeed with opaque kernels within, but that the ſame cauſe, which produceth them in the round grains, could alſo produce them in Cylinders: Which being ſuppoſed to be ſuch as the IV. Figure repreſents them, *viz.* oblong icy grains, and roundiſh at both ends, having the inner kernel of the ſame ſhape, it was found, that from their different diſpoſitions all the appearances of the *Parhelia* and their *Circles* did neceſſarily follow.

And *firſt*, that ſome of theſe Cylinders being erect, in the ſituation which probably they ought to have in being formed, there muſt appear in the Heavens a great white Circle, parallel to the Horiſon, paſſing through the Sun, and of near the ſame breadth with him; as hath been obſerved in the *Phænomenon* of *Rome* A. 1629. of which *Gaſſendus* and *Des-Cartes* have written, and which is here exhibited in the V. Figure. That this Circle L K N M is cauſed by the reflection of the rays of the Sun upon the ſurface of theſe Cylinders; it being eaſy to demonſtrate, that there are none but thoſe, which are raiſed at the ſame angle above the Horizon with that of the height of the Sun, that can reflect his rays to our Eye. Whence it manifeſtly follows, that it muſt appear White, and throughout of equal altitude with the Sun itſelf, and by conſequence parallel to the Horizon. That conſidering afterwards the Tranſparency of theſe perpendicular Cylinders, and their opaque kernels, it is eaſily ſeen, that thoſe of the white Circle, which are diſtant from the Sun at a certain angle, begin to give paſſage to his rays to ſtrike our eyes, in the ſame manner as hath been ſaid of the round half-dark Grains. That theſe Cylinders are thoſe, which on each ſide of the Sun make us ſee a *Parhelion* in the great white Circle, as hath been noted in the Obſervation of *Rome* (where they are mark'd with K and N) and in many others. That theſe *Parhelia* have commonly luminous tayles, becauſe the Cylinders, which follow thoſe firſt ones that form the *Parhelia*, and which are yet further diſtant from the Sun, let alſo paſs his rays to our Eye, ſo that theſe Tayles may be 20 degrees and more in length. That the ſame *Parhelia* are always colour'd, becauſe they are made by refraction, as the *Halo.*

That beſides, there are two other Images of the Sun, generated by theſe perpendicular Cylinders, and ſo diſpoſed in the great white Circle, that the Spectator, turning his face towards the true Sun, hath them behind him; as in the Roman Obſervation are the *Parhelia* L and M. That theſe are produced by two refractions and one reflexion in theſe Cylinders, in the ſame manner as the ordinary Rain-bow in the drops of water, according as M. *Des-Cartes* hath declared: So that the opaque kernels do nothing to the production of theſe two Suns, but that they may be ſometimes ſo big, as to make them not appear.

That according to the Altitude of the Sun, more or leſs, theſe two *Parhelia* are more or leſs nigh to one another; of which he promiſeth to give the true meaſures in his Treatiſe of *Parhelia*'s.

That they ſhould appear coloured, as the Rainbow, and that ſometimes they have been ſeen ſuch; but that when they are faint, they may alſo ſeem white, even as the *Halo*'s, when they are not very bright.

That theſe ſame perpendicular Cylinders can alſo produce an *Halo* about the Sun, by reaſon of the rounding of their two ends; which maketh, that being diſtant from the Sun at a certain angle, on what ſide ſoever it be, they begin from thence to give paſſage to the rays, tranſmitting them to the Eyes of the Spectator. And *that* theſe *Halo*'s are probably thoſe, we ſee almoſt always paſs through the two *Parhelia* that are on the ſide of the true Sun, as the *Halo* GKNI in the Phænomenon of *Rome*.

That there is yet an other ſcituation of theſe Cylinders very conſiderable, which is of thoſe that are couchant, ſo as their *axes* are parallel to the plan of the Horizon, but turn'd divers ways, ſome one ſome another way, like needles confuſedly thrown on the ground: Which Horizontal diſpoſition is very natural to thoſe Cylindrick Bodies, ſupported by the vapors, which riſe from the earth, as may be made out Experimentally in Bodies thus figur'd, being let fall in the Air.

That it is in theſe Cylinders, that the *Arches*, which touch the *Halo*'s above or below, are formed; ſuch as there were in the *Phænomenon* obſerv'd at *Rome* A. 1630. which is deſcribed

bed by P. *Schenir* in a Letter to M. *Gaſſendus*, as alſo in all thoſe, which *M. Hevelius* hath related at the end of his *Mercurius in Sole.* And *that* the Arch, which appear'd upon this laſt *Halo* at *Paris*, was of the ſame kind. *That* the figure of theſe Arches is different according to the different Altitudes of the Sun, and the ſeveral Magnitudes of the Diameters of the *Halo*'s. *That* when the Sun is very nigh the Horizon ſuch an Arch appearing upon an ordinary *Halo* of 44 degrees, muſt repreſent as twere two Horns, as in the VI. Figure, A B, A C: But that the Sun riſing higher, thoſe Horns become lower in proportion, and make ſuch Arches as are repreſented in the ſame V I. Figure, where each height of the Sun is mark'd near the Arch, which it is to make: Of which the Demonſtrations were reſerved to the ſame Treatiſe of *Parhelia*'s

That the place of the Arches where they touch the *Halo*'s, being more ſtrongly enlightened and coloured than the reſt, maketh us Judge, that there are *Parhelia* in thoſe places.

That the reaſon, why theſe Arches do ordinarily touch a *Parhelion*, was, that the ſame Cylinders couchant, which produce the Arch, produce alſo that *Parhelion*, by the means of their two round and tranſparent Ends, in the ſame manner as hath been ſaid of the perpendicular Cylinders. And *that* the Parhelion laſt ſeen at *Paris* had been formed in theſe couchant Cylinders. *That* that was alſo confirmed, by reaſon that it was brighter in the ſuperior and inferior part, than any where elſe; which neceſſarily coms to paſs in a *Parhelion* cauſed by Cylinders thus diſpoſed, whereas when produced by the round Grains, it muſt appear every where equally ſtrong.

That in theſe ſame Cylinders parallel to the Horizon, there is alſo found the Cauſe of the *White Croſs*, obſerved together with the *Paraſelene*'s or Mock-moons by M. *Hevelius*, and exhibited at the end of his *Mercurius in Sole*: the perpendicular *Fillet* of that Croſs, coming from the reflection of the rays of the Moon upon the ſurface of theſe Cylinders; as the other *Fillet*, parallel to the Horiſon, is produced by the reflection of the perpendicular Cylinders which make the great white Circle, of which this Fillet is a part. That yet the Moon muſt not be very high above the Horizon, to the end that the couching Cylinders may produce this effect: And that it ſhould be well heeded, when the like Meteor ſhall appear, whether the perpendicular Fillet be not narrower where it paſſeth through the Moon, than in other places, and eſpecially upwards, where it muſt grow larger and diſ-appear.

That beſides the perpendicular Cylinders, and thoſe that are couched parallel to the Horizon, there are often a great many, which move to and fro in the Air in all ſorts of poſitions; and *that* thoſe, by the ſame reaſon that the round Grains do, muſt produce an *Halo* about the Sun, and even a more vivid one than that which is cauſed by the Grains, foraſmuch as each Cylinder ſends many more rays to the Eye, than each of theſe little Spheres. *That* the little Halo D E F, in the Roman Phænomenon (*Fig.* V.) may very well have been cauſed by ſuch Cylinders

As to thoſe Mock-ſuns, which ſometimes ſhow themſelves directly oppoſite to the True Sun, (ſuch an one as was publiſhed by M. *Hevelius*, and obſerved *Febr.* 23. 1661;) *that* he could find nothing neither in the round Grains nor in the Cylinders, which ſhould make theſe Suns neceſſarily to meet in the great White Circle, parallel to the Horiſon, and *that*, if that ſhould be always verifyed by future Obſervations, the cauſe of it muſt be lookt for elſewhere: But that in the mean time he did believe, that that hapned not but by chance; which being ſo, a reaſon might be given of theſe Suns by the ſame ſuppoſition, which ſerved alſo for the *Anthelion*, obſerved by M. *Hevelius Sept.* 6. 1661; in which there were two coloured Arches of a Circle, oppoſite to the Sun, which did interſect one another, their interſection being the place of the Falſe Sun. Which although it be repreſented in the Figure of *Hevelius* at the ſame height with the true Sun, yet it was in truth higher by 15 degrees or more; as he hath acknowledged himſelf afterwards: So that, if there had been a great white Circle in this *Phænomenon*, the *Parhelion* was not at all to have been in it.

That for the generation of theſe Suns, he did ſuppoſe a number of ſmall Cylinders with opaque kernels, as the precedent; which were carried in the Air, neither perpendicularly, nor couching

ching, but inclined to the Plan of the Horizon at a certain angle being near an half right one; to which were particularly appropriated thoſe Cylinders, which M. *Des Cartes* ſaw fall from the Heavens, having Stars at both ends: As may be ſeen experimentally, by forming Cylinders of that faſhion, which is repreſented in *Fig.* VII, and letting them deſcend in the Air or in Water. *That* in theſe Cylinders was found, following the *Calculus* to be given in the Treatiſe of *Parhelia's*, not only the Cauſe of the *Anthelia* made by the interſection of two Arches, as in *Fig.* VIII, but alſo that of ſome other Extraordinary Arches and Rods, that are ſometimes obſerved near the Sun, of which notwithſtanding there could nothing be as yet affirmed with certainty, for want of exact and faithful Obſervations.

To make all theſe different effects of the Cylinders manifeſt to the Eye, M. *Hugens* produced one of Glaſs, a foot long, of the ſhape of that in *Fig.* IV; and for the kernel opaque in the middle, a Cylinder of Wood, and the ambient ſpace filled with water, inſtead of tranſparent Ice: Which Cylinder being expoſed to the Sun, and the Eye put in ſuch places as was requiſit, there were ſucceſſively ſeen all thoſe reflexions and refractions, that have been diſcourſed of. Whence it might be concluded, that a great number of the like Cylinders, although very ſmall in compariſon to that, being found in the Air, and having the ſeveral poſtures that have been ſuppoſed, all the Appearances of the *Parhelia* and their Circles muſt exactly follow.

It was wiſhed, for an entire confirmation of the truth of this Hypotheſis, that ſome of thoſe ſmal Cylinders could be obſerved to fall to the ground at the time, when any *Parhelia* do appear: Which he ſhowed could not eaſily be done, becauſe that the vapors, which then riſe from the Earth upwards, and which are the cauſe of their Cylindrical figure, keep them alſo ſuſpended in the Air. He added, that it was not to be thought ſtrange, that ſuch ſmall grains of hail were thus kept up in the Air by the vapors, foraſmuch as theſe, by being rarifyed and dilated upwards, might have motion enough for this effect. *That* that was more eaſy to conceive, than to imagine, how theſe ſame vapors could keep ſuſpended a very great and weighty Circle of Ice, ſuch as M. *Des-Cartes* ſuppoſeth to explicate the cauſe of *Parhelia's* and of the great White Circle of the Roman *Phænomenon.* In which ſuppoſition were alſo to be noted the following difficulties; *viz. That* therein there appears no reaſon, why the White Circle ſhould paſs through the Sun, as is always obſerved, and that it ſhould ſhade him according as he changes in height, though the *Phænomenon* do ſometimes laſt three or four hours: *That* this ſame White Circle, formed of Ice, being ſeen by Spectators diſtant enough from one another, could not appear round to all (as it doth), and to traverſe the Sun: *That*, when *Parhelia* are obſerved, there appears not at all this round Cloud encompaſſed with the Icy Circle, which by its thickneſs ſhould hide a part of the Heavens; but that the Weather ſeems almoſt altogether ſerene, there being none but ſmal clouds, which are ſeen to change places, whilſt the great Circle and the *Parhelia* remain at reſt. *That*, in this Hypotheſis it happens not but by chance, that the *Parhelia*, which are at the ſide of the Sun, appear in the Interſections of an *Halo* and of the great White Circle; which yet is obſerved to come to paſs always, and ſhews, that the Cauſes of theſe *Halo's* and of the *Parhelia* are very little different, againſt the opinion of M. *Des-Cartes.*

A Diſcourſe of Dr R. Wittie, *relating to the Notes of* Dr Foot *in Numb.* 52. *and to thoſe of* Dr. Highmore *in Numb.* 56. *of theſe Tracts; concerning* Mineral Waters, *and* Extracts *made out of them: Communicated to the Publiſher, by way of Letter.*

Sir,

I Muſt always acknowledg myſelf much obliged to you for the reiterated mention you have been pleaſed to make of my Book in your *Tranſactions*, and your patient condeſcenſion to the trouble, that hath enſued therefrom to you, whereas I could not have any ground of hope, that any thing of mine ſhould have fallen under your notice. And this goodneſs of yours gives me encouragement to preſume at this time to deſire your favor in the peruſal of theſe lines, which are occaſioned

oned from ſome Obſervations, I have met with in your ſaid *Tranſactions*, referring to my ſubject.

And *Firſt*, in N°. 51. p. 1039 *l.* 40. in mentioning the Principles of *Scarbrough-water*, there was pretermitted *Vitriol*, which I ſuppoſe was not deſignedly done. This I was to premiſe, becauſe ſome things that follow do refer to that Mineral.

Next, I cannot but take notice of D. *Foot*'s ingenious Notes and Letter in your *Numb.* 52. p. 1050: which he grounds upon your enlarged Account of my Book, about the Volatil parts of Mineral waters, together with his *Queries*. To all which though I might have returned a ſpeedy Anſwer from old Obſervations, yet I was willing to ſtay, till my occaſions could permit me to ſtep over to *Scarbrough* to renew my Experiments; wherein as I reſolved to be more Critical, ſo I hope my return will be more ſatisfactory to all, that are concerned.

As for *Tachenius*, to whom he refers, I cannot get him in *London*, and therefore can ſay nothing to his Principles. It is certain, that theſe ſorts of Mineral waters are more pleaſant to the palat, and alſo more effectual, if they be drunk at the Fountains, then when carried at diſtance: Yet ſome of them will endure carriage much better than others. Such of them, as are impregnated with a *body* of Minerals, as *Scarbrough*, *Malton*, and the *Sulphur-well* at *Knaresbrough*, will better indure carriage than the *Sweet-weell* at *Knares-brough*, and the *Sauvenir* in *Germany* &c. which have imbibed little or nothing but the *Volatil* Spirits or Vapors of ſome Minerals, which quickly evaporate, if removed from their Springs.

Now though *Scarbrough*-water will endure carriage as far as any I know, and yet retain its purging quality, even to many days or weeks, when it ſtinks, becauſe of its large proportion of Mineral Salts, which are not loſt by carriage, and will carry it through the Body; yet certain it is, that it ſuffers a great alteration and decay of vertue, being conveyed at diſtance; which probably muſt proceed from the loſs of ſome volatil parts; whereupon are alſo loſt ſome alterative properties, by which it ſhould fortify the *Craſis* of the Stomach and other Nervous parts, or open Obſtructions, or expel the Stone, *&c*: And thence it is, that I never ſaw a good cure done by it at diſtance. Nor can it be ſuppoſed, that theſe waters, which have in them a Body of Mineral Salts, can want thoſe Volatil Spirits, which others poſſeſs, that have no Minerals at all. Nay its plain, that even *Scarbrough*-water being drunk at the Town, which is but a quarter of a mile from the Spaw, hath nothing ſo pleaſant a reliſh upon the palat, as it hath at the Fountain (and ſome obſerve, its not ſo operative:) But whether that Alteration come from a ſudden loſs of any Spirits, I ſhall not haſtily determin, but do rather chuſe to make it out thus: It is ſuch an Alteration as we obſerve in Wine or Ale, which, after a while, looſes the briske taſte or reliſh, which it had being new drawn out of the Cask, whereby it is not ſo grateful to the Palat, while yet perhaps there is little or no loſs of any Vinous or Frumental Spirit; but then, after a day or two, it becoms whitiſh in Colour, and ſuffers ſome degrees of Putrefaction: Notwithſtanding I could never diſcern it to looſe of its quantity, as *Frambeſarius* and *Van Heer* do affirm concerning the *German*, as I have cited them p. 101. of my Anſwer.

Now, that I may yet more fully make out the truth of what I have aſſerted about the Principles of *Scarbrough-Spaw*, I here preſent to your view theſe ſeveral parts of it, with the manner of Extraction.

As touching the Vitriol, I muſt refer you to my Book, where I hope I have ſufficiently proved it to be one of them, eſpecially to p. 42, 43, 44; ſince, it being *there* principally in its Volatil parts, it cannot be ſo eſpecially repreſented to the ſenſes at diſtance, while yet it is moſt conſpicuous at the Well.

After Diſtillation or Evaporation of the Water, taken clear out of the Fountain, and ſtrained from all ſabulous mixture, there is found that Body of Minerals, ſigned A, *viz.* an ounce in five quarts, and in dry years, 10 drachms: Which I take to be the Product of the five Minerals, *Iron*, *Vitriol*, *Alome*, *Nitre* and *Salt*, which the water is impregnated withal, and ſeems to have a compound taſte of ſharpe Salt, acid, and ſomewhat ſtiptick; and indeed a *tertium* diverſe from them all.

Diſſolve this body of Minerals in pure Spring-water, or diſtilled water, and then filter it through Cap-paper, there will ſtay a little Inſipid Earth in the filter, but the water will be exceeding brackiſh. Evaporate that water away, and there remains the body, ſigned B, which being duly prepared, and time allowed (which I now have not) I have ſometimes ſeen to ſhoot into *Stiria*'s an inch long, being ſet to Chryſtallize in a cold Cellar. This I Judge to be, for the greater part, *Niter*, reſembling much in taſte that *Niter*, which breaks out upon the Cliffe near the Well, mentioned p. 106. of my Anſwer.

Diſſolve again this Body in diſtilled water, and filter it, and the water ſhall be very brackiſh, but there ſhall remain in the filter the powder, ſigned C, which ſeems to be the *Aluminous* part: This is ſometimes found to be like a Chryſtallin ſand, as you have it in the paper, ſigned C C; I think, the difference in the ſhooting ariſeth from the different degrees of heat, which is given it. Evaporat this water away, and you have a *Salt*, mark't D, or that (D D ;) the difference betwixt them is in the degrees of heat: In both which, if you note it, there are ſome ſmall *ſtiriæ*, which I take to be the *nitrous* particles interſperſed. This I have ſometimes depurated, till it hath become as white as Chalk, and yet retained its Saltneſs, as you have it ſigned D D D. Now, whether this Salt be from the Sea, or rather the Salt of all the minerals, I ſhall leave it to others to Judge; My opinion is, that it is nothing elſe than the product of the Minerals, which yet may receive ſome ſmall addition from the Sea.

When the *Spaw*-water is firſt ſet upon the fire, there falls to the bottom a yellowiſh powder, which, if that water be filtred, ſtays behind, mark't E: whether this be the ſame with the *Ochre*, that is found in the bottom of the veſſel, when the water is conveyed at diſtance, I cannot ſay; but they are both of a colour.

Here I had thought to have ſent you the *Black ſediment* (mentioned p. 66. of my Anſwer) which falls to the bottom of the veſſel, after the water hath received a tincture from the Gall, which alſo calcineth of a dark brown colour, which I take to be the *Iron Mineral*; but it being hard froſty weather, when I was laſt at *Scarbrough*, it would not ſeparate. If you deſire it, I ſhall ſupply it in Summer.

Now becauſe my Adverſary hath made a great ruſle about the Calcining of the Minerals, which he ſaith is White, and thereupon endeavors to exclude *Vitriol* and *Iron* from their number; I have ſent you ſome of them ca'cin'd, as they came out of the Crucible, ſigned F, which, you may ſee, have a manifeſt appearance of a red colour, (to uſe his own expreſſion, whoſe words I have cited p. 57. of my Anſwer:) Now ſince this Colour cannot be ſuppoſed to come from *Niter*, *Alom*, or *Salt*, it muſt, even upon his own principles, come from Vitriol, or Iron; and I judge it to come from *Iron*, which is there in its body.

And if you take the body of Minerals, which we firſt ſpake of to be found in the *Spaw-water*, and calcine it, and ſo rub it into a fine powder, and then edulcorate it in pure or diſtilled water, and afterwards filter it, you ſhall find a nitrous Salt, not much different from what was expreſſed before, mark't B, and the other following parts alſo; but a larger quantity ſtays always in the filter, chryſtallized through the more vehement heat of the fire.

But there are other parts, which I fetch out of this body of Minerals, which doubtleſs do much contribute to the Cures performed by this water, and uſed with other vehicles are of ſingular uſe in Hypochondriack diſeaſes. I took ſix ounces of the Minerals, which I put into a Retort, and placed it in a furnace covered with Sand, increaſing the fire gradually, the Receiver being cloſe joyned to the Retort, and ſo luted, as not the leaſt Volatil ſpirit could evaporate. *Firſt*, came this in the Glaſs, ſigned G, about an ounce in quantity, which is the *Phlegm*. Then with another Receiver, as well luted, the heat increaſing, came the acid Spirit, ſigned H, near half an ounce in quantity. I have ſometimes found it much more ſharpe and acid than this is, and indeed I took it too ſoon away from the fire: Yet this giveth a Tincture to a decoction of Roſes, like Spirit of Vitriol or Salt. I have ſometimes obſerved this ſharpe ſpirit like Spirit of Vitriol, to chryſtallize to the ſides of the glaſs, when it hath been long kept, and looſing its acidity to become like the phlegm.

I now come to the *Queries* of D. *Foot*, to which I ſhall ſpeak as to matter of fact, refering the Reaſon of things to be diſcuſſed by better heads.

To the *firſt*, I diſtilled *Scarborough* Spaw-water in a Glaſs-ſtill, luting the Receiver ſo cloſe, that no ſpirit (even of wine) could eſcape me, and it yielded nothing but an inſipid water, as ordinary Spring-water uſes to do: And I think, I may confidently affirm, that none of thoſe Mineral Springs will afford any other.

To the *Second*, The water of *Scarbrough*, and all ſuch as are impregnated with a body of Minerals, whether they be let ſtand, or conveyed at diſtance, do let fall a yellowiſh ſediment in time. But ſo it is not in *Knareſbrough* ſweet-well, nor ſuch others as have no Minerals, but have onely imbibed the Vapors or Odors of ſome Mineral.

To the *third*; When ſuch waters are moved by carriage, they do ſooner precipitate that yellow ſediment to the bottom, and eſpecially if conveyed in oaken veſſels.

To the *fourth*; This yellowiſh ſediment is plainly diſcernable both in their Spring-heads and ſtreams; nay, even *Knaresbrough* water doth a little colour the Ciſtern in tract of time, notwithſtanding it hath very little of the ſubſtance.

To the *fifth*; Thoſe bottles that are ſtop'd cloſe, whether they be moved or not, will longer keep their brisk reliſh, than ſuch as are left open, and alſo longer retain their medical vertues, together with their colour and ſediment.

To the *ſixth*; I find not any difference in the Veſſels, wherein *Scarbrough*-water is put, *viz.* a Glaſs-bottle or an Ox-bladder, ſave this, that that which was in the Bladder would not receive ſo black a tincture from the Gall, as the other, but rather a Claret.

To the *ſeventh*; I could never yet deviſe, nor any other I have met with, to prevent the loſs of the aperient vertue of *Scarbrough*-water, nor to hinder the precipitation of the yellow ſediment, if removed at diſtance.

To the *eighth*; Notwithſtanding that *Scarbrough*-water lets fall the *Ochre*, yet it remains Purgative, from the reſt of the Mineral Salts and Spirits, which yet it retains even till, and when it ſtinks: And perhaps being fetid it may purge the more, as ſome have told me, who have drunk it, when they have been forced to ſtop their noſes, though it hath been with very much prejudice to their health, as I have made out in my former Book, to wit *Scarbrough-Spaw*, (Edit. 2. p. 220, 221.) But as for *Knaresbrough* Sweet-well, *that* will be found enervated, though no *Ochre* appear in the bottom.

To the *ninth*; That of *Knaresbrough*, and ſuch like, are better explicated, to have loſt their vertues by an Avolation of Spirituous parts, ſince they have nothing elſe wherein the vertue can conſiſt: whereas it will not ſerve for *Scarbrough*, from which theſe ſpirits cannot in reaſon be excluded; nay they are found more eminently in the Minerals. And therefore we muſt allow to it, and to ſuch like, an inteſtine Alteration, or Precipitation of their parts, or ſome ſuch Expreſſion, which I refer to the Learned to conſider of.

I now paſs on to ſpeak a few words concerning the 3. Chymical maxims, quoted by D. *Foot*. It is very true, that great Medical vertues do conſiſt in the Volatile Sulphurs of Metals and Minerals; yet we may not exclude their fixed parts from their uſe in Phyſick, as the fix't Salt of Steel, and even Steel it ſelf we uſe with good ſucceſs. And *Schroderus* hath a great many ſingular good medicins, which he prepares even out of the fix't ſalts of all the Metals and Minerals.

That which he obſerves in the ſecond, *viz.* That Acids and Alcalies mutually operate upon one another, even to an utter amiſſion of their former activities, and a production of a *tertium neutrum*; as it is very true, ſo it is ſufficiently verify'd in theſe Minerals, wherewith theſe waters of *Scarbrough* are impregnated; for they are become a quite other thing to what they are in their principles, agreeing in ſome things with them, and yet diſagreeing in other things, as I have made out p. 18, 19. and again p. 61. 62. ſo far as was pertinent to my purpoſe.

Concerning the *third*, there is alſo no doubt to be made of its verity: And as to the *Hypotheſis*, he draws from the ſaid Premiſes, I have had occaſion particularly to ſpeak to it, p. 5, 6. and again, p. 17, 18. and therefore I ſhall ſay no more of it here, but paſs on.

To the *Numb.* 56. p. 1128. which obligeth me to ſay ſomething, and that is to a Letter from Dr. *Highmore*; to which Gentleman I am very much obliged for his Candour in owning any advantage I have gotten of my Adverſary; though he ſaith, being a Stranger to the Water, he cannot judge, whether either of us hath gotten the right of his ſide, and he doubts, whether ſome of the Mineral principles may not be left out.

I have made it appear, that my Antagoniſt, after all his ſevere denials of the Minerals I aſſerted to be in the Water, doth at laſt in his own Book aſſent to them all, p. 112, 113, of my Anſwer. And I cannot take it unkindly, that Dr. *H.* or any other Learned and Ingenious Gentleman, that deſignes not to quarrel, (as he ſaith) ſhould for ſatisfaction ask further queſtions about it. The Doctor is a ſtranger to this water, yet hath my Reaſons for all the Minerals, (beſides my Adverſaries conceſſions,) none of which I could leave out. If he or any other Ingenious perſon, that is not yet ſatisfyed, would be at the paines to take a view (if theſe parts of the water, which I herewith preſent to your view, be not enough) I doubt not but they would return to my opinion.

Next, he wonders, why I mention *Alome* among the reſt, which (he ſaith) *exiccat, adſtringit, incraſſat*; and he underſtands not, how this water ſhould be ſo highly deoppilative, and beneficial to Hypochondriacal and Cachectical perſons, being impregnated with ſo great an Aſtringent, neither (ſaith he) doth the Dr. declare.

By this, as alſo by what follows it appears, that Dr. *H.* did read my Book, while I treated of the Minerals, very ſuperficially, or elſe had much forgotten when he writ that Letter. Nothing is more plain, than that our Water hath imbibed Alome, inſomuch that Mr. *S.* in the former part of his Book againſt me owns nothing elſe almoſt but *Alome*. And for the *adſtringent*, &c. property of Alome, it is very true, what Dr. *H.* ſaith, to which I have alſo ſpoken expreſly, p. 126, 127. of my Anſwer, and plainly proved, that it can neither open Obſtructions nor looſe the Belly, *from thence*. But I have fully evinced, I hope, that all the reſt are there as well as Alome, and treated of them all, and their properties, communicated to this water, in my firſt Book, *viz.* *Scarbrough-Spaw*, Edit. 2. p. 142, 143, 144, 145. Beſides that I have in the ſeveral places of my latter Book touched upon their vertues, as *Vitriol*, p. 71, *&c.* *Iron*, p. 75, 79. *Niter*, p. 85. *Salt*, p. 86. And again more fully of them all, p. 130, 131, 132. So that I have plainly declared both negatively, that it cannot have theſe properties from the Alome; and alſo affirmatively, from whence it hath them; onely from the Stiptick and Aſtringent properties of the *Iron* and *Alome* it is, that this water, though it be purgative, yet never runs the body into Dyſenteries. As to the tinging with Gall (which he mentions) I have proved *that* to proceed from the Vitriol, and that neither Alome crude nor calcined, nor any of the other do communicate that property to the water; excepting in one place of this Cliffe near the *Spaw*, where a little Alome-ſtone, that lyes in the Vitriolin Juyce, which breaks out about the breadth of an hat, will give a tincture with Gall, as the Earth alſo in that ſpot will do, becauſe 'tis impregnated with Vitriol; but all the 100 loads of Alome-Earth beſides, that are in the Cliff, will not do it, neither crude nor calcin'd.

Again, the Doctor wonders, why I make *Iron* and *Vitriol* two diſtinct Conſtituents of this water, and call it *Ferrum Vitriolatum*, inferring that *Iron* and *Vitriol* are both one, and not two diſtinct Minerals.

Theſe are my Adverſaries objections in his Book, to which the *Doctor* is not aware that I have given anſwer: To the *Former*, p. 5, 6 *viz.* that I might diſtinguiſh it from *Vitriolum Cupreum*, which is Emetick. To the *latter*, I have been larger as the matter required, and have given, I think, ſatisfactory reaſons from p. 35, to 41. and clearly prov'd, that they are not the ſame thing. But as theſe Gentlemen will have *Vitriol* and *Iron* to be one thing, ſo I finde Dr. *Jorden* (cap. 7. of *Nat Baths* making a doubt, whether *Alome* and *Vitriol* be diſtinct *in ſpecie*: ſo that by this reckoning it might have ſufficed for all, to have mentioned any of the three, and I might have ſaved my ſelf ſome labour. But I ſuſpect, I ſhould not ſo have ſatisfied the moſt part of Learned men, in ſo confounding three of the principles, but might have expected a more juſt and ſevere reproof for it.

Next, Dr. *H.* obſerves, that I have ſaid, that *Vitriol*, which is found alone upon the Rock will, by the Summer heat be turn'd into *Iron*, and then he makes inference upon the *Hypotheſis*. Which is a miſtake; for I do not ſay ſo in any part of my Book; but p. 45. I do ſay, that ſome of that which is like ordinary Earth, falling down, turns to an *Iron-ſtone*, and is fuſible in the fire.

In the next Sect. he is poſitive about the colour of *Roman* Vitriol, which I ſaid to be factitious. Concerning this, I find Authors much differing. *Galen* (l. 9. de ſimpl. med. fac.) mentions 3. ſorts which he found at *Cyprus*, and tells of a *green* ſort, but not a word of *blew*. So Dr. *Jorden*, c 7. Indeed *Schroderus* and *Adrian Toll* ſpeak of a *blew* ſort. In this diſſent of Writers, I conſulted ſome Learned and obſerving Gentlemen, who had been at *Rome*, and they aſſure me, that the *Romans* adde that colour, when they caſt it into forms. Moreover if that be a right diſtribution of *Vitriols* into their ſeveral kinds, which ſome of our modern Chymiſts make, *viz.* that there are but three ſorts, Vitriol of *Iron*, of *Copper*, and *white* Vitriol, then, I think, it will follow, that I am in the right; for, one is yellow, *viz.* that of *Iron*, the other green, and the white is that, which is made blew. But 'tis not worth the while to contend about it.

In my 120 p. he ſaith, I am diſſatisfied with what my Adverſary aſſerts concerning the Saltneſs of the Sea proceeding from *Foſſil* Salt, *&c.* but rather that I allow the Peripatetical Torrefaction of the Sun to be the Cauſe. All I ſay there, is, that the *Peripateticks* thought, it came ſhort of an adequat cauſe, and thereupon they fly to that torrefaction; but it does not therefore follow, that I allow it. The truth is, I like neither of the Opinions, but have Arguments againſt them both. To ſpeak out, I rather think, the Saltneſs of the Sea to be connatural to it (as the freſhneſs of other water is to it) and that it was made ſo from the beginning, but that I reſerved for another diſcourſe.

As for the Argument which there I brought to back my aſſertion, *viz.* That if the Salt of the Sea ſhould come from *foſſil* Salt, it would kill the Fiſh, he ſaith, it is not convincing. This I ſeconded by an Inſtance concerning the *Salt-Sea*, which kills all fiſh, and thence is called *Mare mortuum*: Which, I think, is of greater force to confirm it, than the Doctors inſtance of Oyſters, which he has experimented to be preſerved by Salt and water, can be to contradict it. For thoſe *Zoophyta* have but a dull and imperfect life, and are not ſo proper to be drawn into inſtance in our caſe. We know, they will keep a long time in their own pickle or moiſture, and we have alſo known them to ſtink, notwithſtanding the addition of Salt and water, and therefore little judgment can be taken from them. It is moſt certain (as he obſerves) that the Inland Salt-ſprings are *ſuch* from foſſil Salt, and it were worth trying, whether thoſe Salt-ſprings would not kill a *Pilchard*, or any other ſort of Sea-fiſh, that liveth a perfect ſenſitive life: but, I fear, Sir, I have been too tedious. You will, *&c.*

An

An Accompt of ſome Books.

I. *The* DIVINE HISTORY *of the* GENESIS *of the* WORLD, *explicated and illuſtrated*, London 1670. *in* 4o.

THis Author (not thinking fit to give us his Name) taketh no ſmall pains to explain in this his Book the *Geneſis* of the *World*, as 'tis delivered by *Moſes*, eſteemed by him the only true Philoſopher. In doing which, he yet profeſſes, that he diſſents not from the *Pagan* Philoſophy out of a Spirit of Contradiction, or to flatter Chriſtianity, but retains whatever of truth he hath found therein, and all the aids of the ſame, whether they be *Platonical* Speculations, *Peripatetical* Ratiocinations, or *Epicurean* Senſations, and even *Sceptical* Caution it ſelf; affirming, that he is *Dogmatical* only in ſuch Poſitions, as he proves by the concurrence of Divine Authority, Human Argument, and Senſible Experiment.

In his *Preface* he ſeems not to be a little diſpleaſed to hear ſome *Chriſtian* Philoſophers affirm, that the very Eſſences and Formalities of all Elementary, Vegetative and Senſitive Natures, are only *Matter* and *Motion*.

In the Body of the Book he endeavors to demonſtrate, that the World had a Beginning, and labors to diſprove the poſſibility of the Worlds being *ab æterno*.

Then, he attempts to give us from the firſt Chapter of *Geneſis* a Body of Natural Philoſophy, diſcourſing of the *Chaos*, the Four Elements, Quantity, Number, Time, Extenſion, Figure, Poroſity, Denſity, Rarity, Gravity, Levity, Reſt, Motion, Place, Space, and Vacuity, (which laſt he rejects, ſhewing himſelf withal a great friend to *Motion* of *Union*;) further of Generation and Corruption and the Proceſſe thereof, together with a Scale and Order of all Generable and Corruptible Natures. Then he proceeds to treat of Heat, Light, Colours, the Air and its Elaſticity; where he examines the *Torricellian* Experiment, not admitting that to be an Inſtance of Vacuity, but eſteeming, that a great force of Introſuction (ſo he calls it) makes temporary pores and pervious paſſages; by which the Air paſſes through the Body of *Mercury* it ſelf into the Tube, and thereby is ſo very much expanded.

After this he conſiders Cold, Sound, Meteors, Water, Odors, Sapors, the Flux and Reflux of Waters, preſenting withal his *Hypotheſis* of *Tydes*, and aſſigning certain *Criteria*, to try its truth by; which done, he goes on to treat of the Earth, and of what is contained in the Bowels thereof; handling alſo of Drineſs, Conſiſtence, Magnetiſme, and Electricity: Further he ſhews himſelf a great Favorer to the *Reſt* of the Earth; and having taken great pains to aſſert the ſame (how ſucceſsfully, good Aſtronomers may judge) he paſſes on to diſcourſe of Vegetables; then of the Celeſtial Bodies, and among them of *Comets*, which he ſuppoſeth to be made up of the *Æthereal Effluvia* of the Luminaries, or the *Confluvia* of the Æthereal matter; as *Aereal* Meteors are made of Vapors.

Further, he diſcourſes of the Formation of Fiſhes and Fowls; then, of Senſation, Imagination, Appetite; Beaſts, Man, Human Body, Human Spirit, the Image of God in Man, and the Immortality of the Human Soul: where he repreſents Man as the Centrick Orbe of the whole World, making him the *Abſtract* thereof, and that one Nature, which all other Creatures do circumferentially reſpect, relating to him one way or another; as ſo many lines in a Circle to the Center.

In the Cloſe, he obſerves two things:

1. The Symmetrical and Uniform *Chorography* of the whole Maſſe of Matter, and of the ſeveral parts thereof, exactly adjuſted according to the more or leſs Denſity of their Matter, and the more or leſs Activity of their Qualities; *viz.* the *Super-æther* (as he terms it) or the utmoſt Circumference of the World; and within that, the *Æther*; and within this, the *Air*; and within them all, the *Terraqueous Globe*; and inmoſt Center thereof.

2. The eaſie Comprehenſion of the *Age* of the World, according to the Moſaical *Chronology*; there being in that not above 150 Generations between *Us* and *Adam*, in regard that that Sacred Writing enumerateth, from *Adam* to *Chriſt* incluſively, no more than 76 Generations; and allowing 4 Generations to every Century ſince the Nativity of Chriſt, the Total will not exceed the number above-ſpecified.

II. *FRANC. TRAVAGINI, Super Obſervationibus à ſe factis tempore ultimorum* Terræ-Motuum, *ac potiſſimum* Raguſiani, *PHYSICA DISQUISITIO, ſeu, GYRI TERRÆ DIURNI INDICIUM.* Lugduni Batavorum, 1669. in 4o.

This *Venetian* Philoſopher acquaints the Curious in this Book with ſome Obſervations, made by himſelf in two late Earth-quakes, and by others alſo, in the laſt about *Raguſa*, whence he thinks an Argument may be drawn to confirm, among other proofs, the *Diurnal Motion* of the *Earth*.

His Obſervations are, that in thoſe Earth-quakes himſelf did find, beſides a *ſubſulting* perpendicular motion, found by others, a concomitant *Lateral* one, from *Weſt* to *Eaſt*; which latter he conceives was not cauſed by the former, (which he alſo endeavors to prove) but only diſcovered by it: juſt as the progreſſive Motion of a Boat, carried with a ſtill ſtream, is not produced, but only made ſenſible, from an accidental check, to a perſon, that ſhall have been put in it aſleep, when it was at reſt, but awakens, after it was made to ſwim down a ſtill River; who will think himſelf un-moved, till the Boat meet with ſome ſtop, whereby for the time its courſe will either be hindred, or diſturbed, and he made ſenſible of his being in motion.

He alleges divers other Obſervations, made of Rivers, ſuſpended Bells, and Church-Lamps, which were all obſerved by himſelf and many others to have likewiſe the ſaid lateral and vibrating motion. Whereupon he admoniſheth his Readers, that they would, on the like occaſions, take very particular notice of all the ſeveral motions in Earthquakes; and then conſider with themſelves, whether from ſuch Obſervations, univerſally made, importing, that the Earth in Earth-quakes is vibrated towards the Eaſt, and that that Vibration cannot proceed from its ſuccuſſation, (which is onely able to cauſe a perpendicular motion in the trembling Earth,) it may be validly inferred, that the Earth hath a Diurnal Progreſſive Motion from Weſt to Eaſt.

III. *QUÆSTIO TRIPLEX De ANNO MENSE & DIE CHRISTI NATI, BAPTISATI & MORTUI.* *Auth.* R. P. Michaele Seneſchallo *è S. J. Leodii*, 1670. in 4°.

THis Author undertaketh to prove in this Chronological Treatiſe not only the Year and Month, but alſo the Day and Hour of the *Nativity* of Chriſt, and of his *Baptiſme* and *Death*. In the doing of which he maketh diligent reſearch of all Writers of Chronology in general, and then examins particularly the Variety of their Opinions concerning the Subject under Conſideration; diſcovering much Induſtry and Learning in all theſe Inquiries.

IV. *HERMANNI GRUBE*, M. D. *Commentarius de Modo SIMPLICIUM MEDICAMENTORUM FACULTATES cognoſcendi.* Hafniæ & Francofurti, 1669. in 8°.

TO this Treatiſe is prefixed an Epiſtle of Doctor *Thomas Bartholin* concerning this very Book and Argument; by which it appeareth, that this Author is not contented with *Ariſtotle* to enquire, Why bitter or ſtrong-ſented Medicaments and Plants do moſtly purge, and fragrant ones provoke to urine; nor with *Galen*, to find out their Vertues by the Colour, Smell and Taſte, but proceeds to particular Experiments, and examines alſo, How and upon what account the Vertues of Plants are diſcoverable by the Smell and Taſte; deſcending to the conſideration of the ſeveral Particles, Figures, and Pores, upon which the diverſity of thoſe Senſations depends; and ſuper-adding the Experiments of ſober *Chymiſts*, and the Principles of the *Carteſian* Philoſophy, to thoſe of *Ariſtotle* and *Galen*.

Mean while the Learned *Bartholin* commends very much the knowledge and uſe of ſimple Native Medicins, eſpecially prepared of *Domeſtique* Plants, and directs to ſuch at home, as may perform the part of *Exoticks*. VVhere he ſpecifieth the uſe of European *Dock* inſtead of *Rhubarb*; of *Elder* inſtead of *Sena*; of *Cumphry* inſtead of *Mechoacan*; of *Iris* inſtead of *Jalap*, &c. For Purgatives he finds at home *Green Barley*, the Powder of *St. John's Wort*, &c. He taketh our *Wallnuts* to be a *Succedaneum* to *Nutmegs*; the Root of *Angelica* to *Coſtus*; *Scordium* or Penny-Royal to the *Dictamne* of *Crete*; the *Sap* of *Firr*, to *Opobalſamum*; the *Geranium Moſchatum*, or ſweet-ſented *Cranes-Bill*, to the *Indian Musk*, &c.

Having done this, he maketh a Reflexion on the Indications taken from Plants by their Taſte, and obſerveth, that though much may be thence collected, yet Experience is the Chief Maſter of all: where he diſdains not to recommend even to great Phyſicians the uſe of ſimple Medicins made of Herbs, uſed by plain Countrey-men, Nurſes, Farriers, *&c.* affirming, that the chief of the Antient Phyſicians, as *Celſus*, *Scribonius*, *Marcellus*, *Dioſcorides* and others have done ſo.

He taketh notice, *Firſt*, That the external likeneſs in ſome Plants is not to be altogether deſpiſed; affirming, that from thence it was diſcovered, that our *Aſhwood*, like to *Guaiacum*, is conducive to the *Lues Venerea*, and other Maligne Diſeaſes. *Secondly*, That neither the outward Signature is to be totally neglected; ſince the Antients thereby did firſt diſcover, that *Hypericum* was good for wounds; *Pulmonaria* for the Lungs; *Saxifraga*, for the Gravel; *Walnuts* for the Diſtempers of the Head. Where he notes, that theſe ſignes do not ſo much reſpect the parts of the Body, as their Diſtemper.

He concludeth with obſerving, that thoſe Plants which afford ſalts of the like Figure, ſeem to evince a likeneſs in their Vertues. Upon this accompt he compareth together *Wormwood* and *Pellitory on the Wall*; *Baulm* and *Fennel*; *Licoriſh* and *Capillus Veneris*; *Roſemary* and *Bugloſſe*, &c.

The Treatiſe it ſelf, to which this Epiſtle is an Introduction, is directed to Medical Practice, and enlarged with divers uſeful Obſervations for the ſake of young Phyſicians.

V. *DE LACTE LUNÆ Diſſertatio Medica*, Johannis Danielis Majoris, *Ph. & M. D.* Kiloni 1667 *in* 4°.

This Book came but very lately to our view; And that the extravagant Name of its Subject may not take off ſober men from conſidering it, we ſhall at the very firſt tell them, that by this affected word of *Lac Lunæ* nothing elſe is meant here, than *Flores Argenti*, or a fine white porous and friable Earth, inſipid and without ſcent, diſſoluble in water, and tinging it with a milky colour, and ſometimes raiſing a kind of ebullition in it; found commonly in Silver-Mines, and in them ſublimed and ſticking to the roofs of the rocky Hills; having a drying and abſterſive quality, and therefore good againſt the afflux of ſharp humors in ulcerated parts; ſerving alſo for an excellent *Coſmetick*. All which particulars are at large deduced and diſcourſed upon by the Author; who obſerveth, *firſt*, That *Geſner* in his Book of *Foſſils* taketh good notice of this Mineral Earth; and affirms it to be found in the Mountains of *Helvetia*, eſpecially that, which is called *Mount Pilat*. From whom he thinks that others, as *Boethius a Boot*, *Olaus Wormius*, *Aldrovandus*, *Calceolarius*, and others, have taken the hint.

Secondly, He maketh the matter of this Earth to be the Metallick Vapors of Silver-Ore, by ſome fermentation raiſed and ſublimed, and then condenſed.

Thirdly, Having commended its *Abſterſive* and *Coſmetique* quality, he giveth this following *Recipe*;

Lact. Lunæ Drachm. VII.
Laccæ Virginian. vel Florentin. Drachm. I.
Moſchi optim. gran. II. *vel* III.
Miſc. exacte, fiat pulvis ſubtilis.

which Powder, *he ſaith*, when 'tis to be uſed for the face or hands, may, for more conveniency, be moiſtened with ſome Eſſence of *Benzoin*, *Roſe-water*, or *Orange water*; whereby the skin ſhall acquire a natural and florid whiteneſs, without any danger of miſchief.

Fourthly, Inquiring into the particular places of the Generation of this Earth, he affirms it to be found, as in the above-named Mountains of *Helvetia*, ſo in the Mines of *New Spain*, and about the *Mexican Bay*, as alſo about *Peruſium* in *Italy*, in an Iſle near *Hamborough*, called *Heilige Land*, belonging to the Duke of *Holſtein*; and in *Sileſia* near *Bruſnitz*.

Errata, In Numb. 58. p. 1186. l. 17. r. *to remove*, p. 1192. l. 12. r. *at Franchin.* p. 1200. l. 16. r. *before noon.*

In Numb. 59. p. 1041. l. 19. r. *Pupilla which dilates*, p. 1045. l. 20. r. *pipe, I took*.

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Numb. 61.

PHILOSOPHICAL TRANSACTIONS.

July 18. 1670.

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SIR,

I Did acquaint you a while ſince, That (beſide the conſideration of. . . . ., which I had in hand;) I had undertaken another Taſk, (almoſt as hard as to make Mr. . . . . . . underſtand Reaſon,) to Teach a perſon *Dumb* and *Deaf*, to *Speak* and to *Underſtand a Language.* Of which if he could do either, the other would be more eaſy: But his knowing neither, makes both harder. And though the Former may be thought the more difficult; the Latter may perhaps require as much of Time. For if a conſiderable Time be requiſite, for him that can ſpeak One, to learn a Second Language; much more for him that knows None, to learn the Firſt.

I told you, in my laſt, that my *Mute* was now at leaſt *Semivocalis*, whereof becauſe you deſire a more particular Information, I thought my ſelf obliged to give you this brief Account of that whole Affair: that you may at once perceive, as well, upon what conſiderations I was induced to Attempt that Work, and what I did propoſe to my ſelf as Feſible therein, as what Succeſs hath hitherto attended that Eſſay.

The Taſk it ſelf conſiſts of Two very different parts; each of which doth render the other more difficult. For, beſide that which appears upon the firſt view, To teach a perſon who *cannot Hear*, to *Pronounce the Sound of Words:* There is that other, of teaching him to *Underſtand a Language*, and know the ſignification of thoſe words, whether ſpoken or written, whereby he may both expreſs his own ſenſe, and underſtand the Thoughts of others: without which latter, that former were only to ſpeak like a Parrot; or to write like a Scrivener, who underſtanding no Language but Engliſh, tranſcribes a piece of *Latin*, *Welſh*, or *Iriſh*; or like a Printer of Greek or Arabick, who knows neither the ſound nor ſignification of what he printeth.

Now, though I did not apprehend Either of theſe impoſſible; yet, that each of them doth render the other more hard, was ſo obvious as that I could not be Ignorant of it. For, how eaſily the underſtanding of a Language is attain'd by the benefit of Diſcourſe, we ſee every day; not onely in thoſe, who knowing one Language already, are now to learn a ſecond; but (which doth more reſemble the preſent caſe) in Children, who as yet knowing none, are now to learn their Firſt Language.

For it is very certain, that no Two Languages can be ſo much different the one from the other, but that the knowledge of the one will be ſubſervient to the gaining of the other: not only becauſe there is now a common Language, wherein the Teacher may Interpret to the Learner the ſignification of thoſe Words and Notions which he knows not, and expreſs his own Thoughts to him; but likewiſe (which is very conſiderable,) becauſe the *common Notions of Language*, wherein all or moſt Languages do agree, and alſo ſo many of the Particularities thereof as are common to the Language he knows already, and that which he is to learn, (which will be very many,) are already known; and therefore a very conſiderable part already diſpatched, of that work which will be neceſſary for the teaching of a Firſt Language, to him who as yet knows none.

But to this diſadvantage (of teaching a Firſt Language,) when that of *Deafneſs* is ſuper-added, it muſt needs augment the difficulty: ſince it is manifeſtly evident from Experience, That the moſt advantageous way of teaching a Child his Firſt Language, is that of *perpetual Diſcourſe*; not onely what is particularly addreſſed to himſelf, as well in pleaſing divertiſements, or delightful ſportings, (and therefore inſinuates it ſelf without any irkſom or tedious labour,) as what is directly intended for his more ſerious Information: But that diſcourſe alſo which paſſeth between others; where, without pains or ſtudy, he takes notice of what Actions in the Speaker do accompany ſuch words, and what Effects they do produce in thoſe to whom they are directed; which doth, by degrees, inſinuate the intendments of thoſe words.

And, as that Deafneſs makes it the more difficult to teach him a Language: ſo on the other hand, that want of Language, makes it more hard to teach him how to ſpeak or pronounce the Sounds. For there being no other way to direct his Speech, than by teaching him how the Tongue, the Lips, the Palate, and other Organs of ſpeech, are to be applyed and moved in the Forming of ſuch ſounds as are required; to the end that he may, by *Art*, pronounce thoſe

Sounds, which others do by *Cuſtome*, they know not how; it may be thought hard enough to expreſs in writing, even to one who underſtands it very well, thoſe very nice Curioſities and Delicacies of motion, which muſt be obſerved (though we heed it not,) by him, who without help of his Ear to guide his Tongue, ſhall form that variety of Sounds we uſe in ſpeaking: Many of which Curioſities are ſo nice and delicate, and the difference in forming thoſe Sounds ſo very ſubtile, that moſt of our ſelves, who pronounce them every day, are not able, without a very ſerious conſideration, to give an account, by what Art or Motion our-ſelves form them; much leſs to teach another how it is to be done. And if, by writing to one who underſtands a Language, it be thus difficult to give Inſtruction, how, without the help of Hearing, he may utter thoſe Sounds, it muſt needs increaſe the Difficulty, when there is no other Language to expreſs it in, but that of Dumb ſigns.

Theſe Difficulties (of which I was well aware) did not yet ſo far diſcourage me from that undertaking, but that I did ſtill conceive it poſſible that both parts of this Taſk might be effected.

As to the Firſt of them; Though I did not doubt but that the Ear doth as much guide the Tongue in ſpeaking, as the Eye doth the Hand in writing, or playing on the Lute: and therefore thoſe who by accident do wholly loſe their Hearing, loſe alſo their Speech, and conſequently become Dumb as well as Deaf; (for it is in a manner the ſame difficulty, for one that Hears not, to ſpeak well; as for him that is blind, to write a fair hand:) yet, ſince we ſee that 'tis poſſible for a Lady to attain ſo great a Dexterity, as, in the dark, to play on a Lute, though to that variety of nimble motions, the Eyes direction, as well as the Judgment of the Ear, might ſeem neceſſary to guide the Hand; I did not think it impoſſible, but that the Organs of Speech might be taught to obſerve their due Poſtures, though neither the Eye behold their Motion, nor the Ear diſcern the Sound they make.

And as to the other; That of Language might ſeem yet more poſſible. For, ſince that in Children, every day, the Knowledge of words, with their various Conſtructions and Significations, is by degrees attained by the Ear; ſo that, in a few years, they arrive to a competent ability of Expreſſing themſelves in their firſt Language, at leaſt as to the more uſual Parts and Notions of it; Why ſhould it be thought impoſſible, that the Eye (though with ſome diſadvantage) might as well apply ſuch Complication of Letters or other Characters, to repreſent the various Conceptions of the mind;as the Ear,a like Complication of Sounds? For though, as things now are, it be very true that Letters are, with us, the immediate Characters of Sounds, as thoſe Sounds are of Conceptions: yet is there nothing, in the nature of the Thing it ſelf, why Letters and Characters might not as properly be applyed to repreſent Immediately, as by the Intervention of Sounds, what our Conceptions are.

Which is ſo great a Truth, (though not ſo generally taken notice of,) that 'tis Practiced every day; not onely by the *Chineſes*, whoſe whole Language is ſaid to be made up of ſuch Characters as to repreſent Things and Notions, independent on the Sound of words;and is therefore differently ſpoken, by thoſe who differ not in the Writing of it: (like as what, in Figures, we Write, 1, 2, 3, for *One*, *Two*, *Three*; a Frenchman, for example, reads *Un*, *Deux*, *Trois*:) But, in part, alſo amongſt our ſelves; as in the Numeral Figures now mentioned, and many other Characters of Weights and Metals, uſed indifferently by divers Nations to ſignifie the ſame Conceptions, though expreſſed by a different Sound of words: And, more frequently, in the practice of Specious Arithmetick, and operations of Algebra, expreſſed in ſuch Symbols, as ſo little need the Intervention of Words to make known their meaning, that, when different perſons come to expreſs,in Words,the ſenſe of thoſe Characters, they will as little agree upon the ſame Words, though all expreſs the ſame ſenſe, as two Tranſlators of one and the ſame Book into another Language.

And, though I will not diſpute the Practical poſſibility of introducing an *Univerſal Character*, in which all Nations, though of different ſpeech, ſhall expreſs their common Conceptions; yet, that ſome Two or Three (or more) perſons may, by conſent, agree upon ſuch Characters, whereby to expreſs each to other their ſenſe in Writing, without attending the Sound of words; is ſo far from an impoſſibility, that it muſt needs be allowed to be very Feſible, if not Facile. And, if it may be done by new-invented Characters; why not as well by thoſe already in uſe? Which though to thoſe who know their common uſe, may ſignifie Sounds; yet to thoſe that know it not, or do not attend it, may be as immediately applied to ſignifie Things or Notions, as if they ſignified nothing elſe: And conſequently, ſo long as it is purely Arbitrary, by what Character to expreſs ſuch a Thing or Notion; we may as well make uſe of that Character or Collection of Letters, to expreſs the Thing to the Eyes of him that is Deaf; by which others expreſs the Sound or Name of it to thoſe that Hear. So that, indeed, that ſhall be, to Him, a Real Character, which expreſſeth to Another a vocal Sound; but ſignifieth, to Both, the ſame Conception: Which is, To underſtand the Language.

To theſe Fundamental Grounds of Poſſibility in Nature, I am next to add a Conſideration which made me think it Morally-poſſible; that is, not impoſſible to ſucceed in Practice. And, becauſe I am now giving an Account to one who is ſo good a Friend to Mathematicks, and Proficient therein, I ſhall not doubt but this Conſideration will have the force of a great ſwaſive. Conſidering therefore, from how few and deſpicable Principles the whole Body of Geometry, by continual conſequence, is inforced; if ſo fair a Pile, and curious Structure may be raiſed, and ſtand faſt upon ſo ſmall a Bottom; I could not think it incredible, that we might attain ſome conſiderable ſucceſs in this Deſign, how little ſoever we had at firſt to begin upon: and, from thoſe little Actions and Geſtures, which have a kind of Natural ſignificancy, we might, if well managed, proceed gradually to the Explication of a compleat Language, and withal, direct to thoſe curioſities of Motion and Poſture in the Organs of ſpeech, requiſite to the Formation of a Sound deſired; and, ſo to effect both parts of what we intend.

My next Inducement to undertake it, was a conſideration of the Perſon, (which, in a work of this nature, is of no ſmall concernment;) who was repreſented to me as very Ingenious and Apprehenſive, (and therefore a fit ſubject to make an Eſſay upon;) and ſo far at leaſt a Mathematician as to Draw Pictures; wherein, I was told, he had attained ſome good ability, which did induce me to believe that he was not uncapable of the Patience, which will be neceſſary to attend the Curioſity of thoſe little varieties in the Articulation of Sounds; being already accuſtomed to obſerve and imitate thoſe little Niceties in a Face, without which it is not poſſible to Draw a Picture well.

I ſhall add this alſo, That, once, he could have ſpoken, though ſo long ago, that (I think) he doth ſcarce remember it. But having, by accident, when about five years of age loſt his Hearing, he conſequently loſt his ſpeech alſo; not all at once, but by degrees, in about half a years time: which though it do confirm what I was ſaying but now, How needful it is for the Ear to guide the Tongue in Speaking, (ſince that Habit of Speaking, which was attained by Hearing, was alſo loſt with it,) and might therefore diſcourage the undertaking; yet I was thereby very much ſecured, that his want of Speech was but a conſequent of his want of Hearing, and did not proceed originally from an Indiſpoſition in the Organs of Speech to form thoſe Sounds. And though the neglect of it in his younger years, when the Organs of Speech, being yet tender, were more pliable, might now render them leſs capable of that Accurateneſs which thoſe of Children attain unto: (whereof we have daily experience; it being found very difficult, if not impoſſible, to teach a Forraigner well in years, the Accurate pronouncing of that Sound or Language, which in his tender years he had not learned:) yet, if he can attain to ſpeak but ſo well as a Forraigner, at his years, may learn to ſpeak Engliſh; what ſhall be farther wanting to that Accurateneſs which a

Native from his Childhood attains unto, may, to an indifferent eſtimate, be very well diſpenſed with.

Having thus acquainted you with thoſe Conſiderations which did induce me to attempt it; leaſt you may think I build too confidently thereupon, and judge me guilty of too much vanity, in promiſing my ſelf a greater ſucceſs than can, in reaſon, be hoped for; It will next be neceſſary to give you ſome account, what meaſure of Succeſs I might propoſe to my ſelf as probable, in ſuch an undertaking.

And as to the firſt part of it, (that of *Speaking*;) Though I did believe, that much more is to be effected than is commonly thought Feſible, and that it was poſſible for him ſo to ſpeak as to be underſtood; yet I cannot promiſe my ſelf, that he ſhall ſpeak ſo Accurately, but that a Critical ear may eaſily diſcern ſome Failures, or little differences from the ordinary tone or pronunciation of other men; (ſince that we ſee the like every day, when not Forraigners only, but thoſe of our own Nation in the remoter parts of it, can hardly ſpeak ſo Accurately, as not to diſcover a conſiderable difference from what is the common Dialect or Tone at *London*.) And this not onely upon the conſideration laſt mentioned; (concerning the Organs of Speech leſs pliable to thoſe Sounds to which they were not from the firſt accuſtomed;) but eſpecially upon that other conſideration, concerning the Ears uſefulneſs to guide and correct the Tongue. For as I doubt not; but that a Perſon, who knows well how to Write, may attain, by cuſtome, ſuch a Dexterity, as to write in the Dark tolerably well; yet it could not be expected, that he ſhould perform it with the like Elegancy, as if he ſaw the Motions of his hand: ſo neither is it reaſonably to be expected, that he who cannot Hear, though he may know how to ſpeak Truly, ſhould yet perform it ſo Accurately, as if he had the advantage of his Ear alſo.

Nor can I promiſe, nor indeed hope, that how Accurately ſoever he may learn to ſpeak, he ſhould be able to make ſo great Uſe of it as others do. For ſince that he cannot hear what others ſay to Him, as well as expreſs his own Thoughts to Them; he cannot make ſuch uſe of it in Diſcourſe as others may. And though it may be thought poſſible, that he may, in time, diſcern, by the motion of the Lips, viſible to the Eye, what is ſaid to him; (of which I am loth to deliver a poſitive judgment, ſince much may be ſaid conjecturally both ways;) yet this cannot be expected, till at leaſt he be ſo perfectly Maſter of the Language, as that, by a few Letters known, he may be able to Supply the reſt of the Word; and by a few Words, the reſt of the Sentence, or at leaſt the ſenſe of it, by a probable conjecture, (as when we Decipher Letters written in Cipher:) For, that the Eye can actually diſcern all the varieties of Motion in the Organs of Speech, and ſee what Sounds are made by thoſe Motions, (of which many are Inward, and are not expoſed to the Eye at all,) is not Imaginable.

But as to the other Branch of our Deſign, concerning the Underſtanding of a Language: I ſee no reaſon at all to doubt, but that he may attain This, as perfectly as thoſe that Hear; and that, allowing the like Time and Exerciſe, as to other men is requiſite to attain the Perfection of a Language, and the Elegance of it, he may Underſtand as well, and Write as Good Language as other men; and (abating onely what doth directly depend upon Sound, as Tones, Cadencies, and ſuch Punctilio's,) no whit inferiour to what he might Attain to, if he had his Hearing as others have. And what I ſpeak of him in particular, I mean as well of any other Ingenious perſon in his Condition; who, I believe, might be taught to uſe their Book and Pen as well as others, if a right Courſe were taken to that purpoſe.

To tell you next, What Courſe I have hitherto uſed towards this Deſign, it will not be ſo neceſſary. For ſhould I deſcend to Particulars, it would be too Tedious; eſpecially ſince they are to be uſed very differently, and varied as the preſent Caſe and Circumſtances do require. And, as to the General way, it is ſufficiently Intimated already.

As to that of Speech; I muſt firſt, by the moſt ſignificant ſigns I can, make him to underſtand, in what Poſture and Motion I would have him apply his Tongue, Lips, and other Organs of Speech, to the Forming of ſuch a Sound as I direct. Which if I hit right, I confirm him in it: If he miſs, I ſignifie to him, in what he differed from my Direction; and, to what Circumſtances he muſt attend to mend it. By which means, with ſome Trials, and a little Patience, he learns firſt one, then another Sound; and, by frequent Repetitions, is confirmed in it; or (if he chance to forget) Recovers it again.

And for this Work, I was ſo far prepared before hand, that I had heretofore, upon another occaſion, (in my Treatiſe *De Loquela*, prefixed to my *Grammar* for the *Engliſh Tongue*,) conſidered very exactly (what few Attend to) the Accurate Formation of all Sounds in Speaking, (at leaſt as to our own Language, and thoſe I knew:) without which, it were in vain to ſet upon this Taſk. For, if we do not know, or not conſider, how we Apply our own Organs in Forming thoſe Sounds we Speak, it is not likely, that we ſhall, this way, Teach another.

As to that of Teaching him the Language: I muſt (as Mathematicians do from a Few Principles firſt granted,) from that little ſtock (that we have to Begin upon) of ſuch Actions and Geſtures as have a kind of Natural ſignificancy, or ſome Few Signs, which himſelf had before taken up to expreſs his Thoughts as well as he could, Proceed to Teach him, what I mean by ſomewhat elſe; and ſo, by ſteps, to more and more: And this, ſo far as well I can, in ſuch Method, as that what he Knows already, may be a ſtep to what he is next to Learn; as, in Mathematicks, we make uſe, not of Principles only, but Propoſitions already demonſtrated, in the Demonſtration of that which follows.

It remains now, for the Perfecting the Account which at preſent you deſire of me, only to tell you, what Progreſs we have already made. Which, had not your Deſires commanded from me, I ſhould have reſpited a while longer, till I might have made it ſomewhat Fuller.

He hath been already with me ſomewhat more than Two Moneths. In which time, though I cannot be thought to have Finiſhed ſuch a Work; yet the Succeſs is not ſo little, as to Diſcourage the Undertaking: but as much as I could hope for in ſo ſhort a time; and more than I did Expect. So that I may ſay, the Greateſt difficulty of Both Parts being almoſt over; what Remains, is little more than the work of Time and Exerciſe. There is hardly any Word, which (with deliberation) he cannot Speak; but, to do it Accurately, and with Expedition we muſt allow him the Practice of ſome conſiderable Time, to make it familiar to him.

And, as to the Language; though it were very Indifferent to him who Knew none, which to begin withal; yet, ſince it is out of Queſtion, that *Engliſh*, to him, is like to be the moſt Uſeful and Neceſſary; it was not adviſeable to Begin with any other. For though he can Pronounce the Latine with much more Eaſe, (as being leſs perplexed with a multitude of concurring Conſonants;) yet this is a Conſideration of much leſs concernment than the other.

To this therefore having applyed himſelf, he hath already Learned a great many Words, and, I may ſay, a conſiderable part of the *Engliſh*, as to Words of moſt Frequent uſe: But the whole Language being ſo Copious, though otherwiſe Eaſy, will require a longer Time to Perfect what he hath Begun.

And this, Sir, is the full Hiſtory of our Progreſs hitherto. If you ſhall hereafter eſteem our Future Succeſs, worthy your taking notice of, You may Command that, or what elſe is within the power of

Oxford,
March 14. 166$\frac{1}{2}$.

S I R,

Your Honours very humble
Servant,

John Wallis.

The

THE Perſon, to whom the foregoing Letter doth refer, is Mr. *Daniel Whaley* (Son of Mr. . . . . . *Whaley*, late of *Northampton*, and Mayor of that Town.) He was (ſoon after the date of this Letter) on the 21 of *May*, 1662. preſent at a Meeting of the *R. Society* (of which the *Regiſter* of that days proceedings takes particular notice,) and did in their preſence, to their great ſatisfaction, pronounce diſtinctly enough ſuch words as by the Company were propoſed to him; and though not altogether with the uſual Tone or Accent, yet ſo as eaſily to be underſtood: Whereupon alſo the ſaid Doctor was, by the ſame Aſſembly, encouraged to purſue what he had ſo ingeniouſly and ſo ſucceſsfully begun. About the ſame time alſo (His Majeſty having heard of it, and being willing to ſee him) he did the like ſeveral times at *Whitehall*, in the preſence of His Majeſty, His Highneſs Prince *Rupert*, and divers others of the Nobility, though he had then employed but a ſmall time in acquiring this ability. In the ſpace of one year, which was the whole time of his ſtay with Dr. *Wallis*, he had read over a great part of the Engliſh Bible, and had attained ſo much ſkill as to expreſs himſelf intelligibly in ordinary affairs; to underſtand Letters written to him, and to write Anſwers to them, though not elegantly, yet ſo as to be underſtood: And in the preſence of many Forraigners (who out of Curioſity have come to ſee him,) hath oft-times, not only read *Engliſh* and *Latin* to them, but pronounced the moſt difficult words of their Languages (even *Poliſh* it ſelf,) which they could propoſe to him. Since that time, though he hath not had opportunity of making much further improvement for want of an Inſtructour, yet he doth yet retain what he had attained to; or, wherein he may have forgot the niceneſs requiſite in the pronunciation of ſome Sounds, doth eaſily recover it with a little help.

Nor is this the only Perſon on whom the ſaid Doctor hath ſhewed the effect of his ſkill, but he hath ſince done the like for another (a young Gentleman of a very good

Family, and a fair Eſtate,) who did from his birth want his Hearing. On this occaſion I thought it very ſuitable to give notice of a ſmall *Latin* Treatiſe, of this ſame Authour, firſt Publiſhed in the year 1653, intituled *De Loquela* [of *Speech,*] prefixed to his *Grammar of the Engliſh Tongue* (Written alſo in *Latin.*) In which Treatiſe of *Speech* (to which he refers in this diſcourſe, and on confidence of which he durſt undertake that difficult taſk) he doth very diſtinctly lay down the manner of forming all Sounds of Letters uſual in Speech, as well of the Engliſh, as of other Languages, which is, I think, the firſt Book ever Publiſhed in that kind, (for, though ſome Writers formerly have here and there occaſionally ſaid ſomething of the Formation of ſome particular Letters; yet none, that I know of, had before him undertaken to give an account of all.) Whether any, ſince him, have with more judgment and accurateneſs performed the ſame, I will not take upon me at all to determine. In his *Grammar of the Engliſh Tongue* (to which this *of Speech* is prefixed) he hath ſo briefly and clearly given an account of this Language, as may be very advantagious, not only to Strangers for the eaſy attainment thereof, but even to the Engliſh themſelves for the clear diſcovering (which few take notice of) the true *genius* of their own Language.

A Relation,

Concerning the Sal-Gemme-Mines *in* Poland; *communicated by a Curious Gentleman of* Germany, *who, ſome years ſince, deſcended himſelf into thoſe Mines, to the depth of* 200 *Fathoms, and was led about in them for the ſpace of three hours.*

THE Mines of *Sal-Gemme* in *Poland*, a mile diſtant from *Cracovia*, near the ſmall Town of *Wilizka*; which (the *Church* excepted) is altogether digged hollow under ground, hath Eight deſcents, of which the two chief, being in the Town it ſelf, are thoſe through which the Salt is drawn up; the other two do ſerve for letting down Timber and other neceſſaries. Theſe deſcents, or holes, are five ſquare, four or five foot long, and as broad, lined downwards thorough with Timber. Above, is a great Wheel, with a ſtrong rope, of the thickneſs of a luſty arm, drawn about by a Horſe, like in a Horſ-mill.

He that will deſcend, muſt cover himſelf with a Frock, and have another man, that faſtens another rope to the aforeſaid big rope, and having ſo tyed it about himſelf as to ſit in it, takes one in his lap and holds him faſt about; whereupon the big rope being let ſomewhat down, another faſtens likewiſe a piece of rope to the other thick rope, and does like the former, ſeating himſelf in it, and taking and claſping another man in his lap, and being alſo let down a little way gives place to others to do the like; in which manner, thirty, fourty and more perſons may be let down all at once; of whom the firſt having touch't the ground, ſteps out and goes aſide, the reſt following him and doing the like. And thus they deſcend to the depth of 100 Fathoms. But then they take a Lamp, and lead people about by ſtrange paſſages and Meanders, ſtill more and more deſcending, till they come to certain Ladders, by which they go down an 100 Fathoms deeper, where there are double paſſages and holes one above another, in abundance; for the Mine-men dig on ſtill, and cut out every where and on all ſides, as long as the Salt-vein laſteth, and Salt is found; but the Vein being loſt, and no more Salt appearing in one place, they ſearch for other Salt-veins; whence come ſo many holes and paſſages out of one into another. The great holes, to ſecure both the Town above, and the work below from falling in, are very carefully filled out and ſupported by ſtrong and well-compacted Timber; of which there is enough in thoſe Works to build a big Town with.

Out of theſe Mines they dig and cut out three ſorts of Salt; one is common, courſe and black; the ſecond ſomewhat

what finer and whiter; the third, very white, and clear like Chryſtal. The courſe and black Salt is cut out in great pieces, roundiſh, and three Polonian Ells long, and one Ell thick, which coſts fifty to ſeventy Polonian Florins. Mean time the inhabitants of *Cracow* have a priviledge, whereby a certain number of pieces is to be deliver'd to them, eight ſuch Florins the piece. The great pieces lye at *Cracow* about the Streets, before the doors of the Citizens; as alſo in the Country, in the ſmall Towns and Villages, and before the Forts and houſes of the Nobility; Where the Cattel, paſſing to and fro, lick of thoſe Salt-ſtones; which afterwards by Mills and other Engines are grownd and beaten ſmall for uſe.

The *Colour* of theſe Salt-ſtones is Darkiſh gray, with ſome mixture of Yellow. The Inſtruments, wherewith they are digg'd and cut out, have almoſt all *German* names with *Polonian* terminations; for, when this Salt-work was firſt found, (which is now above four hundred years ago) the Mine-men, that firſt began to work in it, were *Germans*; whence the *Poles* have retain'd thoſe names of the Tools, but given them *Poliſh* terminations.

Theſe Salt-works belong to the King of *Poland*, who appoints and maintains the Officers of them; and 'tis one of his beſt Royal Revenues, amounting to conſiderable ſums of moneys. There is no leſs than a thouſand men, that are conſtantly employed in theſe Mines; and there was then a proviſion of Salt, valued at two Millions.

There are in theſe Works three Horſes, that ſtay always below having their Stable and other neceſſaries there: they carry the Salt from the places, where 'tis cut and digg'd out, to thoſe; whence 'tis by the abovemention'd Wheel and Ropes drawn up, by a Horſe above ground, going round about. The Horſes, after they have been a while under-ground, grow blind from the ſharpneſs of the Salt; and all the three, which then laboured there, were quite blind; and one of them, that had been longeſt in thoſe Mines, had the hoofs of his feet grown as long again, as they are uſually, ſo that each hoof was near a ſpan long.

This Salt-work hath alſo beneath it certain Salt-ſprings, whence the Saltwater is by Channels conveyed to ſeveral places, where 'tis boyled to Salt.

But there is yet another Mineral Salt-work in *Poland*, *viz.* at *Bochna*; but not ſo well order'd, as the former. Beſides there are divers other places in *Poland*, and in *Ruſſia* alſo, which yield Salt; as at *Holitz*, *Colomeja*, *Solum*, *Pintz*, *Oſwentz*, *&c.* In the *Podolian* deſert, near the River *Boriſthenes*, is a Salt-lake, whoſe water is by the heat of the Sun waſted, and turn'd to Salt, ſo that the people there ride into it with Horſes and Waggons, like unto Ice, and cut it into pieces, and carry it away; as the Poliſh Hiſtorian *Cromerus* at large relateth; who alſo affirms, that in the aforeſaid *Salt-work* at *Bochna* they find a Frozen ſubſtance, which by them is called *Carbuncle*, uſed by the people to purge their Bodies, by grating and drinking it in a convenient vehicle.

The Way of making Vinegar in France, *Communicated to the* Publiſher, *by an Ingenious Phyſitian of that Nation, living at a place, where much of it is made.*

THey take two great Caſks, within each of which they put at the bottom a Trevet, which muſt be one foot high, and as large, as the largneſs of the Caſk permits. Upon this Trevet they put Vine-twiggs, whereon they lay a ſubſtance call'd *Rape*, with which they fill both Veſſels within half a foot from the top. This Rape is nothing elſe, but the wood or ſtalks of the Cluſters of Grapes, dryed and freed from the Grapes. The Trevet and the Vine-branches are put at the bottom of the Caſks, only to keep the Rape from ſetling at the bottom. It is this Rape, which alone heats and ſowrs the Wine. The two

Veſſels being almoſt quite filled with the Rape, one of them is filled up with Wine, and the other only half full for the time; and every day they draw, by a cock, half the Wine, that is in the full Veſſel, therewith quite to fill up the other, that is but half full; obſerving enterchangeable turns of filling and unfilling the Veſſels. Ordinarily, at the end of two or three dayes, the half-filled Veſſel begins to heat, and this heat augments for ſeveral dayes ſucceſſively, continuing to do ſo till the Vinegar is perfectly made; and the Workmen know, that the Vinegar is made by the ceaſing of the heat. In Summer it is a work of fifteen dayes; in Winter it proceeds more ſlowly, and that according to the degree of Cold weather.

When the weather is hotteſt, the wine muſt be drawn twice a day, to put it out of one Veſſel into the other. It is only the half filled Caſk that heats, and as ſoon as you have done filling up, its heat is choaked and ſtopped for the time, and the other Caſk, which is unfilled, begins to heat.

The full Veſſel is quite open at the top; but a wooden cover is put on the Veſſel, that is but half full.

The beſt Wine makes the beſt Vinegar; but yet they make good Vinegar of Wine that is turned.

The Wine, in changing, leaves a certain Greaſe, which ſticks *partly* to the ſides of the Caſk, (and *that* they take care to do clean away) *partly* to the Rape; ſo that if they cleanſe not the Rape from it almoſt every year once, the Wine turns into a whitiſh liquor, which is neither Wine nor Vinegar.

At the time when they pour the Wine out of one Veſſel into the other, a ſcum ariſeth on the top of the Veſſel, which muſt be carefully taken away.

In the Caſks, which have never ſerved for this purpoſe before, the Vinegar is made more ſlowly, than in ſuch, that have been uſed already.

So far the firſt communication concerning this matter: In which occurring ſeveral particulars, requiring further Information, and they being ſent to the Author, he was pleaſed to return what follows.

TIs ſo far, that the Rape is put into any place to ſowr before it be caſt into the Vinegar-veſſels, that as ſoon as 'tis ſeparated from its Grapes (which is done immediately after Vintage,) it is carefully put up in Barrels, leaſt it take Air; without which it would heat it ſelf, and be ſpoyled.

There is no other way of keeping the Rape that hath once ſerved already, than to drown it; that is to ſay, to fill the Veſſel, wherein it is, with Wine or Vinegar. Rape will ſerve a year, more or leſs, provided that care be taken of cleaning every morning, with a piece of Linnen, the greaſe that is on the ſides of the Veſſel; and with a little broom, that which ſwims on the top of the liquor. The Rape may be freed from its greaſe with water; rubbing it between ones hands.

No body, that I know, hath hitherto examin'd what this Greaſe is. When I can get a fit quantity of it, I will endeavour to make ſome Experiments about it; eſpecially if I be aſſiſted with Suggeſtions for making proper ones.

I have been lately inform'd, that there have been Merchants here, who made Vinegar with phlegme of Wine, remaining after that the *Aqua vitæ* is extracted from it.

An Account of ſome Books.

I. *MECHANICA, ſive De MOTU Tractatus Geometricus; PARS SECUNDA; in qua, De CENTRO GRAVITATIS Ejuſque CALCULO: Auth.* Johanne Wallis, *SS. Th. D. Geometriæ Profeſſ. Saviliano in Celeberr. Acad. Oxonienſi; Regalis Societ. Sodali, & Regiæ Majeſtati à Sacris. Londini, Impenſis* Moſis Pitt *in Vico vocato* Little Britain, 1670. in 4°.

IN this *Second* Part (amongſt many other things, in this and the foregoing Part, *Demonſtrated*, which are wont to be *Poſtulated*, but ſhould be Proved;) the Excellent Author *demonſtrates* the Center of Gravity *to be*(which hath not been done formerly, that we know of, by any;) and that, as to all *Ponderation*, the *whole weight* may juſtly be reputed There to *be*, where is its *Center of Gravity*; and ſo much to be mov'd: with other general *Affections* thereof. He ſhews alſo, from General Principles, How, by Calculation, to determine, as well the *Magnitude*, as the *Center of Gravity*, in innumerable ſorts of *Lines*, *Surfaces*, and *Solids*, (and the *Aggregates* or *Differences* of ſuch.) As, in all *Right-lined Figures* whatſoever; in all *Solids bounded by Plains*; in *Cones* alſo and *Cylinders*: And in *Curve-lined Figures* innumerable; not only (with *Archimedes*) in the *Parabolar* Figure, but likewiſe in all *Paraboloeids* whatever (and the *parts* of ſuch;) together with their *Ungular* Solids inſiſting on them; and their *Conoeids* or other Solids made by the *Converſion* (perfect, or imperfect,) of thoſe Plains (or their Parts) about any *Axe* in the ſame Plain aſſigned; and the *Center of Gravity* of all theſe *Solids*. And the like alſo in other Figures *Reciprocal* to theſe Paraboloeids, infinitely continued between ſuch Curves and their Aſymptotes: Shewing, which of thoſe Figures (*infinitely Long*) are of *Finit* magnitude, (and what that is;) which, of *Infinit*: and, which of them have, which have not, *Centers of Gravity*; and, in thoſe which have, how to Aſſign them: And the like of the *Unguls* appertaining to

them,

them, and the *Solids* made by their *Converſion* about an *Axe:* In many of which, the Magnitude of the *Ungle* or *Solid* is ſhew'd to be but *Finit*, where the Magnitude of the reſpective *Plain* (on which they ſtand, or by whoſe converſion they be made) is *Infinit:* and (contrary-wiſe) in Others, the Magnitude of the *Ungle* or *Solid* to be *Infinit*, where that of the *Plain* is but *Finit*.

He gives alſo General *Methods*, How, from the *Center of Gravity* of a *Plain* (or of *Lines* deſcribed in a Plain) whoſe Magnitude is alſo known; to find the Magnitude of the *Ungles*, and *Solids* made by Converſion thereof about aſſigned Axes; and, from *Theſe*, to find *That:* with other like Proceſſes, from *Plains* to *Solids*, and ſo onward. He ſhews not only (with *Archimedes*) the *Solidity* and *Surface* of the *Sphere* and *Cylinder*; but of their *Segments* and *Portions*, cut off by a Plain, or any number of Plains, in what manner ſoever; and the *Center of Gravity* of the ſame: moſt of which (as to the Solidity and Center of Gravity) is in like manner applicable to the *Spheroid*; uſeful in *Guaging* Veſſels, and otherwiſe. He ſhews particularly, that the *Scalene Cylindrick Surface*, is to the *Erect*, as the *Perimeter of an Ellipſe* to that of a Circle.

He ſhews the Center of Gravity of all *Arches* of Circles, with their *Superficial Unguls*, and the *Surfaces* made by the *Converſion* of ſuch Arches about aſſigned *Axes*. And the like, of the *Sectors*, *Segments*, and other *Portions of Circles*, (which are applicable alſo to thoſe of *Ellipſes*;) with the *Unguls*, and *Solids* made by ſuch *Converſion*; and their *Centers of Gravity*. He doth the like in the *Cycloid*, ſhewing the length of the *Curve*, and of the *Portions* thereof, with their *Centers of Gravity*, and their ſeveral *Superficial Unguls*, and *Surfaces*, made by *Converſion*, and the *Centers of Gravity* of all theſe. As likewiſe the Magnitude of the *Plain*, as well of the *Primary Cycloid*, as of the *Secundary*, whether *Contracted* or *Protracted*; with their ſeveral *Tangents:* and of the *Segments* and *Portions* of thoſe Plains; with their ſeveral *Unguls*, and *Solids* made by their Converſion (Perfect, or Imperfect,) and the *Centers of Gravity* of all theſe: Wherein in he proſecutes at large, what was deliver'd in his Book *De Cycloide*, formerly publiſh't; continuing his *Calculations* (which were there begun) to a great number of Particular Caſes, which (for reaſons then aſſigned) were there omitted, and which have not by any hitherto been computed.

He doth the like, in the *Figure of Right-Sines*, in the Figure of *Verſed Sines*, and of *Arches*; aſſigning the *Magnitude* of thoſe *Figures*, and of their *Segments* and *Portions*; with their *Unguls*, and *Solids* by *Converſion*; and the *Centers of Gravity* of all theſe. Whence (amongſt many other things) are deduced the *ſums* of the *Right-Sines*, *Verſed Sines*, and *Arches*, appertaining to any aſſigned Portion of a Circle; and the *Sums* of their *Squares*, *Cubes*, or other *Powers*.

He doth the like in *Spiral* Figures, as well that of *Archimedes*, as an infinit number of *other Spirals*; ſhewing the *Magnitude* of the ſeveral *Parts* or *Sectors*; with their *Centers of Gravity*; (all applicable alſo to their reſpective *Sealar Solids*:) and the reſpective *Paraboloeids* with which they Symbolize, and by whoſe *Convolution* they are made; their *Tangents* alſo, with much more concerning them. He proſecutes the ſame in part, but more briefly, in the *Ciſſoeid*, and *Conchoeid*, and the *Figure* of *Tangents*; as to the *Magnitude* of thoſe Figures, and the Parts thereof; their *Unguls*, *Solids*, and *Centers of Gravity*. He ſhews particularly as to the *Ciſſoeid*, how it doth ſymbolize with the *Cycloeid*, the parts of the one figure being equal to the reſpective parts of the other: And, as to the *Conchoeid*, That its Plain is in Magnitude (as well as Longitude) Infinite; yet a Solid made by its Converſion, equal to a finit Cylinder.

He ſhews alſo the *Quadrature* of the *Hyperbola*, and *parts* thereof; their *Unguls*, *Solids*, and *Centers of Gravity*: As alſo, an *Hyperbolical Solid, made by the Converſion of a Streight Line about an Axis not in the ſame Plain*; ſhewing the *Magnitude* of that *Solid*, and of its *Parts*, and their *Centers of Gravity*; and the ſeveral *Sections* of that *Solid made* by *Plains* in any aſſigned poſition; being *Parabola's*, *Hyperbola's*, *Ellipſes*, *Circles*, *Parallelograms*, and *Triangles*; according to the different Poſitions of the Cutting Plains: With many other particulars , too many to be here rehearſed.

In ſhort,you have here well nigh All or the Greateſt part of the moſt abſtruſe and intricate Speculations , as well of the Antient as the Moderns Geometers, hitherto diſcover'd, (with many new Additionals ;) briefly and clearly deduced from Peculiar Principles and Methods of his own ; (eſpecially thoſe of his *Arithmetica Infinitorum* ;) which are alſo in like manner applicable to Innumerable other Caſes , as occaſion ſhall require. And his Method (in this and the former part) deducing all from the firſt principles , doth ſcarce depend upon any other Treatiſes as neceſſary to the underſtanding ; ſave only the knowledge of ſome very ordinary things in common Geometry, and ſome few Propoſitions out of his own *Arithmetick of Infinits*, with ſome ſkill in the practice of *Numerous* and *Specious* Arithmetick.

II. *EXERCITATIONES MECHANICÆ*, Alexandri Marchetti. *Piſis*, 1669. *in* 4°. *To be found at Mr.* Starky's *near* Temple Bar.

THis Author declareth, that though many Eminent men have already treated of the Subject of this his Book, as *Ariſtotle*, *Archimedes*, *Lucas Valerius*, *Guldinus*, *Galileus* and others ; yet hath he not been deterred from writing of the ſame Argument,eſteeming, that he hath handled it more largly, more diſtinctly,and more clearly and eaſily : which, how he does actually perform , we leave to Mathematical Mechanicians to Judge.

III. *The Natural Hiſtory of NITER, or, a Philoſophical Diſcourſe of the Nature, Generation , Place, and Artificial Extraction of NITER, with its Vertues and Uſes, by WILLIAM CLARKE. London*, 1670. *in* 8°.

The Author of this Tract, eſteeming, that moſt, who have known this Mineral Body, ſeem to have had but a *partial* knowledge of it, undertaketh to deliver here its *Compleat* Hiſtory; And therefore

Firſt, deſcribeth *Niter* by its properties,*Figure* (like tha of Needles,) *Taſte* (ſalt, ſharp and cooling,) and *Inflam* *mability*, having this peculiar, that it burns *downwards.*

Secondly, giveth ſome Chymical Analyſis of *Niter*, both by *calcination*, in which he ſaith that it burns almoſt all away if refined; and by *Deſtillation in a Retort*, which maketh it yield a little Flegme, then a Spirit, firſt in the form of a white, and ſoon after in that of a red vapour, corroſive and fetid, leaving a *Caput mortuum* behind. Where the Author giveth us his opinion, that this Body being thus analyſed is rendered incapable of Redintegration; (concerning which the Reader may conſult that Noble and Experienced Philoſopher Mr. *Boyle*, in his *Eſſay* containing an Experiment with ſome Conſiderations touching the differing parts and Redintegration of *Salt-petre*; Printed 1661.)

Thirdly, examines the Queſtion, whether *this* Niter is the ſame with the Niter of the *Antients*; and reſolveth it in the *Affirmative.*

Fourthly, enquireth into the Generation and Place of Niter; Where he diſcuſſeth that *Inquiry*, whether in Houſes, or Walls, Earthen floars, &c. *Niter* be *generated*, or *ſeparated* and drawn from the Air by the heat and dryneſs of the Places; obſerving, that the dryer the places, where Niter is, are kept, there is more *Niter.* Whereupon he diſcourſeth largely of the Niter in the *Air*, and making it not only a *Meteor* it ſelf, and particularly a cauſe of lightning and thunder, but a *general* cauſe of Meteors, joyntly with *Sulphur.*

Fifthly, he declareth the *Uſe* of Niter to *Animals* and *Vegetables*; affirming *firſt*, that the life of Animals, being a burning *Sulphur*, is, as't were, kindled by the *Nitrous* Air received into the Lungs and communicated to the Heart; and adding that as without Air, which is the life of Fire, the innate animal-heat would extinguiſh; ſo that Air, being *Nitrous*, not only inflames it, but from its Coolneſs ſo allays the ſame, that it doth not too much prey upon our Radical moiſture, and keeps our life in its due Fermentation; and moreover, by its diſſolving nature renders the humors of the Body more fluid, and ſo more apt to perform their Circular motions, for the entertaining of life. *Secondly*, that without this *Nitroſity* the Sulphur of Seeds would lye dormant in the Earth, be ſcorched up and wither'd, nor paſs into the pores of Plants.

Sixthly, he delivers the Artificial manner of Extracting and Refining of Niter; after he had firſt inform'd his Reader, How it may be known, whether a place be impregnated with Niter or no?

Seventhly, he giveth the *Vertues* and *Uſes* of Niter; *firſt* in *Phyſick*; where he affirms it to be not only *Cooling*, at leaſt by removing hot humors, whereby the Body may become cooler; but alſo *Reſolving*, *Purgative* and *Diuretical*: Upon the ſcore of all which properties 'tis uſed not only in *Burning Feavers*, in the form of the *Lapis prunellæ*, (the preparation of which he deſcribeth;) but alſo in thoſe Diſeaſes, in which are to be diſcharged by ſiege and Urine, hot, ſharp, cholerick and obſtructive humors. Having diſpatched this Medicinal uſe, he proceeds *next* to the uſe of Niter in *Chymiſtry*; where he obſerveth that by it may be made a pleaſant and cooling Acid; or a hot and burning Corroſive: that ſometimes it revives the Vomitive and Purgative vertue of *Antimony*, ſometimes it kills the Vomitive, and reviveth only the Purgative, and ſometimes it deſtroyes both, and quickens neither the Diuretick or Diaphoretick, &c. beſides that it Calcineth, Sublimeth and Diſſolveth *Minerals* and *Metals*. *Thirdly*, he adds the Uſe of Niter in *Artillery*; where he diſcourſes of the reaſon of the Compoſition and Force of *Gun-powder*, together with the Uſe and Office of every Ingredient of the ſame. *Fourthly* and laſtly, he ſets down the Uſes of Niter for *Refiners*, *Dyers* and *Cooks*.

ADVERTISEMENT.

THe Author of the Diſcourſe concerning *Mineral waters*, in Numb. 60. begining *p.* 1074, deſireth, that theſe lines may be inſerted *p.* 1081. after the word *Dyſenteries*, *l.* 19. *viz.* Neither do I think this water any thing the worſe becauſe of the *Alome*, but much the better for it in Hypochondriack maladies: For by its adſtringency it defends the Tone of the Liver and the other natural parts, which otherwiſe are apt to be debilitated by purging and penetrating medicines; it being, according to *Galen*'s advice, ever neceſſary to intermix ſome Adſtringents with Hepatick remedies; in Art. Med. c. 95. to which agree very good writers, antient and modern.

Errat. p. 1096. l. 2. r. *if he bit.*

LONDON,
Printed by *T.R.* for *John Martyn*, Printer to the *Royal-Society*. 1670.

Numb. 62

PHILOSOPHICAL TRANSACTIONS.

Auguſt 8. 1670.

The CONTENTS.

New Pneumatical Experiments about Reſpiration, *made and communicated by the Honourable* Robert Boyle, *in ſeveral Heads*; viz. *Obſervations made about the laſting of* Ducks, *included in the Exhauſted Receiver: Of the Phænomena afforded by* Vipers, Froggs, *and* Kitlings *in ſuch a Receiver: Some Tryals about the Air uſually harbour'd in the* Pores *of water: Of ſome Phænomena afforded by* Shell-Fiſhes, *and* Scale-Fiſhes *in the Pneumatical Engin: Of two Animals, included, with large wounds in the Abdomen; as alſo of the Motion of the ſeparated Heart of a Cold Animal, in the ſame Engin: A Compariſon of the Time, wherein Animals may be kill'd by Drowning, or by withdrawing of the Air.* The reſt reſerved for the next Month. *An Accompt of three Books*; I. *De* ANGLORUM GENTIS ORIGINE, *Auth.* Roberto Sheringham, *Cantabrigienſi.* II. *A Vindication of HYDROLOGIA CHYMICA, by* William Sympſon, *M.D.* III. *A Diſcourſe in Vindication of* DES-CARTES's *Syſteme by M.* Des-Fourneillis; *together with the Syſtem General of the ſame CARTESIAN Philoſophy, by* Francis Bayle, *M. D. now both Engliſh'd out of French.*

NEW PNEUMATICAL EXPERIMENTS about RESPIRATION.

Theſe Experiments, made by that Indefatigable Benefactour to Philoſophy, the Honourable Robert Boyle, *in order to bring ſome more Light to the Doctrine of RESPIRATION, as well as to miniſter occaſion to Inquiſitive Naturaliſts to make farther Reſearches into the ſame, were by their Noble Author communicated to the Publiſher of theſe Papers; who eſteem'd it more convenient to make them a part of theſe Tracts (they taking up the room but of a few ſheets) than to publiſh them any other way.*

The I. Title.

Obſervations made about the laſting of Ducks *included in the Exhauſted Receiver.*

NAture having, as *Zoologiſts* teach us, furniſhed *Ducks* and other water-Fowl with a peculiar ſtructure of ſome veſſels about the heart, to enable them, when they have occaſion to

Dive, to forbear for a pretty while reſpiring under water without prejudice; I thought it worth the tryal, whether ſuch Birds would much better than other Animals endure the abſence of the Air in our exhauſted Receiver. The Accounts of which tryals were, when they were made, regiſtred as follows.

Experiment the 1.

We put a full-grown *Duck* (being not then able to procure a fitter) into a Receiver, whereof ſhe fill'd, by our gueſs, a third part or ſomewhat more, but was not able to ſtand in any eaſy poſture in it; then pumping out the Air, though ſhe ſeemed at firſt (which yet I am not too confident of, upon a ſingle tryal,) to continue well ſomewhat longer than a Hen in her condition would have done; yet within the ſhort ſpace of one minute ſhe appeared much diſcompoſed, and between that and the ſecond minute, her ſtrugling and convulſive motions increaſed ſo much, that, her head alſo hanging careleſly down, ſhe ſeemed to be juſt at the point of death; from which we preſently reſcued her by letting in the Air upon her: So that, this Duck being reduced in our Receiver to a gaſping condition within leſs than two minutes, it did not appear, that, notwithſtanding the peculiar contrivance of nature to enable theſe water-Birds to continue without reſpiration for ſome time under water, this Duck was able to hold out conſiderably longer than a Hen, or other Bird not-Aquatick, might have done: and to manifeſt, that it was not cloſeneſs and narrowneſs of the veſſel, in reference to ſo bulky an Animal, that produced in the ſubject of our tryal the great and ſuddain change above-recited, we ſoon after included the ſame Bird in the ſame Receiver, and having by a ſpecial way cemented it on very cloſe, we ſuffered her to ſtay thus ſhut up with the Air for five times as long as formerly (by our gueſſe, helped by a watch,) without perceiving her to be diſcompoſed; and ſhe would probably have continued longer in the ſame condition, if my patience and leiſure would have held out ſo long, as ſhe could have done in that priſon.

Experiment the 2.

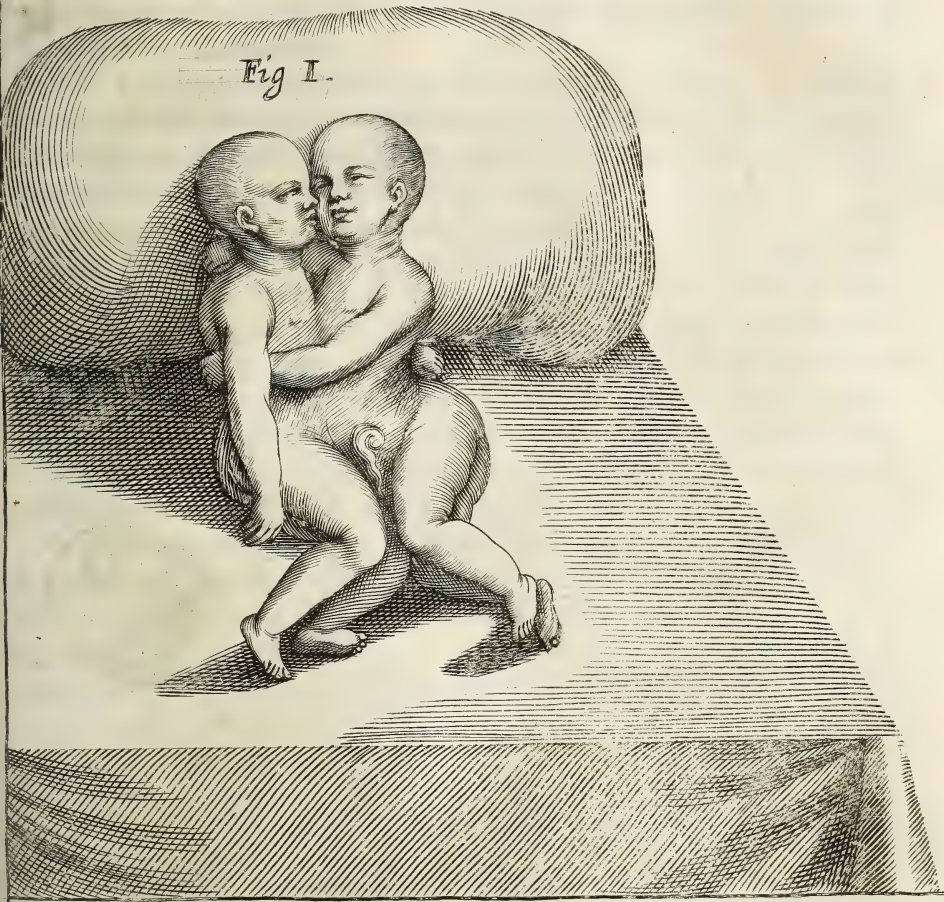
Having at the ſeaſon of the year procured a *Duckling*, that was yet Callow, we conveyed her into the ſame Receiver wherein the former had been included, and obſerved, that, though for a while ſhe appeared not much diſquieted, whilſt the Air was pumping out of the glaſs, yet before the firſt minute was quite ended, ſhe

gave

Tab: 2.

Trans. N°. 65

Fig I.



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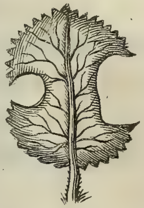

III

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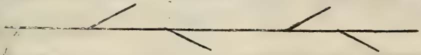
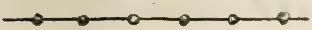
VII



VIII



BRITISH MUSEUM
NATURAL HISTORY.

gave manifeſt tokens of being much diſordered; and the operation being continued a while longer, ſhe grew ſo much worſe, that ſeveral convulſive motions, ſhe fell into before a ſecond minute was expired, obliged us to let in the Air upon her, whereby ſhe quickly recovered.

NB. I determine not, whether it be proper in this place to add, that when the Receiver was pretty well exhauſted, the included Bird appeared to the Spectators manifeſtly bigger, than before the Air was withdrawn, eſpecially about the crop, though that was very turgid before. And to manifeſt, that in this Duck, as in the former, the convulſions, that uſed to be immediately followed by Death, proceeded from the *withdrawing* of the ambient Air, and not from the *clogging* of it; we kept the ſame Duckling in the ſame Receiver very cloſe, to keep out all external Air, and to keep in the excrementitious ſteams of her body for above 6 min. without perceiving her to grow ſick upon her impriſonment; which yet laſted above thrice the time, that ſufficed to reduce her in the abſence of the Air to a gaſping condition.

NB. It not being intended, that Ducks and other water-Fowl ſhould any more than other Birds live in an exceeding rarified Air, but only be able to continue upon occaſion a pretty while under water, it may ſuffice, that the contrivance of thoſe parts, which relate to Reſpiration, be ſo far fitted for the purpoſe, as we ſhall ſee it is when we come to the *Tenth* Title.

The II. Title.

Of the Phænomena afforded by Vipers *included in an Exhauſted Receiver.*

COnſidering that Vipers are Animals endowed with Lungs (though of a differing ſtructure from thoſe of Men, Dogs, Cats, Birds, &c.) and that their bloud is, as to ſenſe, actually cold; I thought, it might upon both thoſe accounts be very well worth trying, what effect the withdrawing and abſence of the Air would have upon Animals ſo conſtituted. I therefore made divers tryals, ſome of which did not diſpleaſe me; but I know not by what misfortune the memorials of them were loſt, except two or three (which were not perfect,) that I ſhall here ſubjoine.

Experiment the 1.

We included a Viper in a ſmall Receiver, and as we drew out the Air, ſhe began to ſwell, and afforded us theſe Phænomena. *Jan.* 2. 166$\frac{2}{3}$.

1. It was a good while after we had left pumping, ere the Viper began to ſwell ſo much as to be forced to gape, which afterwards ſhe did.

2. That ſhe continued, by our eſtimate, above 2½ hours in the exhauſted Receiver without giving clear proof of her being killed.

3. That after ſhe was once ſo ſwelled, as to be compelled to open her jaws, ſhe appeared ſlender and lank again, and yet very ſoon after appeared ſwelled again, and had her jaws disjoined as before.

Experiment the 2.

We took a Viper, and including her in the greateſt ſort of ſmall Receivers, we emptied the glaſs very carefully, and the Viper moved up and down within, as if it were to ſeek for Air, and after a while foamed a little at the mouth, and left of that foam ſticking to the inſide of the glaſſe: Her body ſwelled not conſiderably, and her neck leſſe, till a pretty while after we had left pumping; but afterwards the body and neck grew prodigiouſly tumid, and a bliſter appeared upon the back. An hour and an half after the Exhauſtion of the Receiver (which we then by tryal found to be pretty ſtaunch) the diſtended Viper did give by motion manifeſt ſigns of life; but we obſerved none afterwards. The Tumor reached to the neck, but did not ſeem much to ſwell the under-chap. Both the neck and a great part of the throat, being held betwixt the eye and the candle, were tranſparent enough, where the ſcales did not darken them. The jaws remained mightily opened, and ſomewhat diſtorted; the *Epiglottis* with the *rimula Laryngis* (which remained gaping) was protruded almoſt to the further end of the nether-chap. As it were from beneath this *Epiglottis* came the black tongue, and reached beyond it, but ſeemed by its poſture not to have any life, and the mouth alſo was grown blackiſh within: but the Air being readmitted after 23 hours in all, the Viper's mouth was preſently cloſed, though ſoon after it was opened again, aud continued long ſo; and ſcorching or pinching the tail made a motion in the whole body, that argued ſome life.

Experiment the 3.

April 25. To theſe Experiments upon Vipers, I ſhall add one, made upon an ordinary harmleſs *Snake*.

We included ſuch an Animal, together with a *Gage*, in a pretty portable Receiver, which, being exhauſted and well ſecured againſt the ingreſs of the Air, was laid aſide in a quiet place, where it continued from 10 or 11 a clock in the forenoon, till about 9 the next morning; and then my occaſions calling me abroad, I looked upon the Snake, which, though he ſeemed to be dead, and gave no ſigns of life upon the ſhaking of the Receiver, yet upon holding the glaſs a convenient diſtance from a moderate fire, he did in a ſhort time manifeſt himſelf to be alive by ſeveral tokens, and even by putting forth his forked tongue. In that condition I left him, and, by reaſon of ſeveral avocations, came not to look upon him again till the next day early in the after-noon; at which time he was grown paſt recovery, and his jaws, which were formerly ſhut, gaped exceeding wide, as if they had been ſtretched open by ſome external violence.

The III. Title.

Of the Phænomena afforded by Frogs *in an Exhauſted Receiver.*

THe ſame conſiderations that induced me to make tryals upon Vipers, did alſo invite me to make ſeveral upon *Frogs*; the ſucceſs of ſome of which, the following Notes will declare. *Sept. 9. 1662.*

Experiment the 1.

We took a large luſty *Frog*, and having included her in a ſmall Receiver, we drew out the Air, and left her not very much ſwelled, and able to move her throat from time to time, though not ſo faſt as when ſhe freely breathed before the Exuction of the Air. She continued alive about two hours, that we took notice of, ſometimes removing from the one ſide of the Receiver to the other; but ſhe ſwelled more than before, and did not appear by any motion of her Throat or Thorax to exerciſe Reſpiration, but her head was not very much ſwelled, nor her mouth forced open. After ſhe had remained there ſomewhat above three hours (for it was not 3½ hours) perceiving no ſign of life in her, we let in the Air upon her, with which the formerly tumid body ſhrunk very much, but ſeemed not to have any other change wrought in it; and though we took her out of the Receiver, yet in the free Air itſelf ſhe continued to appear ſtark dead. Nevertheleſs to ſee the utmoſt of the Experiment, having cauſed her to be laid upon the graſs in a Garden all night, the next morning we found her perfectly alive again.

Experiment the 2.

June 29.1660. About 11 of the Clock in the fore-noon, we put a *Frog* into a ſmall Receiver, containing about 15¼ *ounc.* Troy weight of water, out of which we had tolerably well drawn the Air, (ſo that when we turned the cock under water, it ſucked in about 13¼ *ounc.* of water:) The Frog continued in it (the Receiver all the while under water) lively enough till about 5 of the clock in the afternoon, when it expired. The Frog at the firſt ſeemed not to be much altered by the exuction of the Air, but continued breathing both with her throat and lungs.

Experiment the 3.

*Sept.*6.1662. We included into a pretty large Receiver a couple of Frogs newly taken, the one not above an inch long, and proportionally ſlender; the other, very large and luſty. Whilſt the Air was drawing out, the leſſer Frog ſkipped up and down very lively, and, ſomewhat to our wonder, clambered up ſeveral times to the ſides of the Receiver, inſomuch that he ſometimes wreſted himſelf againſt the ſide of the glaſs. When his body ſeemed to be perpendicular to the Horizon, if not in a reclining poſture, he continued to ſkip up and down a while after the exuction of the Air, but within a quarter of an hour (meaſured by a minute-watch) we perceived him to lye ſtark dead with his belly upwards. The other Frog, that was very large and ſtrong, though he began to ſwell much upon the withdrawing of the Air, and ſeemed to be diſtreſſed, by his frequently leaping up after the Air was drawn out, which he did not before, yet being as we ſaid very luſty, he held out half an hour, at which time it was remarkable, that the Receiver, though it had held out againſt the preſſure of the outward Air, during that ſpace of time, notwithſtanding that a piece of it had been cracked out, and was mended with a cloth deep'd in Cement, yet at the end of the half hour, the weight of the outward Air ſuddenly beat it in, and thereby brought the impriſoned Frog a reprieve, which hindered us from bringing the Experiment to an iſſue.

Experiment the 4th.

Sept. 11. We took a ſmall Frog, and having conveyed her into a very ſmall portable Receiver, we began to pump out the Air. At firſt ſhe was lively enough, but when the Air began to be conſiderably withdrawn, ſhe appeared to be very much diſquieted (leaping ſometimes after an odd manner, as it were to get out of the uneaſy priſon,) but yet not ſo, but that, after the operation was ended and the Receiver taken off, the Frog was perfectly alive, and continued to appear ſo (if I am not miſtaken) near an hour, though the Abdomen was *very much*, and the throat *ſomewhat* extended; this latter part having alſo left that wonted panting motion, that is ſuppoſed to argue and accompany the reſpiration of Frogs. At the end of about 3¼ hours, after the removal of the Receiver from the pump, the Air was let in; whereupon the Abdomen, which by that time was ſtrangly ſwelled, did not only ſubſide, but ſeemed to have a great cavity in it, as the throat alſo proportionably had; which cavityes continued, the Frog being gone paſt all recovery.

Experiment the 5th.

April 14. A large Frog was conveyed into a plated Receiver, and the Air being withdrawn, her body by degrees was diſtended; as appeared very notably, when by a caſual ſpringing of a leak, the Air got in again, and made her look much more lank and hollow than ever. The Receiver with the *Gage* were kept under water near ſeven hours, becauſe I was obliged to ſtay long abroad; at the end of which coming home I found the Receiver ſtaunch, but the Frog dead and exceedingly ſwelled: upon the letting in of the Air, ſhe became more hollow and lank than ever.

NB. I have purpoſely, both under this *Title* and ſome others, ſubjoyned ſome Tryals, whoſe events are not altogether ſuch, as others, recited under the ſame head, would invite one to expect; but I purpoſely do it, not only to be true to the Impartiality, I propoſed to my ſelf in writing theſe Narratives, but to awaken the curious to conſider and obſerve what variety of *Phænomena*, in ſuch tryals, may be attributed to the ſeaſon of the year, wherein they are made; and to the ſtrength, bulk, age, peculiar conſtitutions, &c. that relate to the reſpective Animal, on which the Experiments are made; beſides, what things may on other accounts be fit to be alſo conſidered.

The IV. Title.

Of the Phænomena afforded by a newly kitten'd Kitling *in the Exhauſted Receiver.*

BEing deſirous to try, whether Animals, that had lately been accuſtomed to live either without *any*, or without a *full* Reſpiration,

ſpiration, would not be more difficultly or ſlowly killed by the want of the Air, than others, which had been longer uſed to a free Reſpiration; We took a *Kitling* that had been kitten'd the day before, and put it into a very ſmall Receiver (that we gueſſed to hold about a pint or leſs) that it might be the ſooner exhauſted. As ſoon as the pump began to play, I took notice of the time, and found by a Watch, that marks Minutes and Quarter-Minutes, within one minute or a little more after the Air firſt began to be withdrawn, that the little Animal, who in the mean time had gaſped for life, and had ſome violent convulſions, lay as dead with his head downwards, and his tongue out; but upon letting in of the Air, he did in a trice ſhew ſigns of life, and being taken out of the Receiver quickly recovered: And to allow him the benefit of his good fortune, we ſent for a Kitling of the ſame age and litter, which being put into the ſame Receiver, quickly began, like the other, to have convulſions, after which he lay as dead; but obſerving very narrowly, I perceived ſome little motions, which made me conclude him alive; which I ſoon found I had cauſe to do. For though we continued pumping, and could not perceive that the Engine leaked more than in the former Experiments; the Kitling began to ſtir again, and after a while had ſtronger and more general convulſions than before; till at the end of full ſix minutes after the Exuction of the Air was begun, the Animal ſeeming quite dead, the outward Air was readmitted into the Receiver, which not reviving him as it had done the other, he was taken out of the veſſel, and lay with his mouth open, and his tongue lolling out without any ſenſible breathing, and pulſation; till having ordered him to be pinched, the pain or ſome internal motion, produced by the external violence done to him, made him immediately give manifeſt ſigns of life, though there was yet no ſenſible motion of the heart or the lungs; but afterwards gaping and fetching his breath in an odd manner, and with much ſtraining, as I have ſeen ſome *Fœtus's* do, when cut out of the womb, he little by little, within about a quarter of an hour, recovered: wherefore thinking it ſevere to make him undergo the ſame meaſure again, we ſent for another, kitten'd at the ſame time, and incloſing that alſo in the Receiver, obſerved, that divers violent convulſions, as it were gaſping for breath, into which he began to fall at the ſecond or third ſuck, ended in a ſeeming death, within about a minute and an half. But being made more diffident by the late Experiments,I cauſed the pump to be plyed, and the rather, becauſe I had a mind to obſerve, whether when the Air was from time to time drawn away, there would not,upon the opening of the ſtop-kock to let it out, appear ſome ſudden ſwelling, greater or leſs,of the body of the Animal,by the ſpring and expanſion of ſome Air (or Aërial matter) included in the Thorax, or the Abdomen. Such an inflation (though not great) we thought we obſerved; but till further tryal I dare not acquieſce in it. A while after,notwithſtanding our continuing to pump, the Kitling gave manifeſt ſigns of life, which was not till it had endured divers convulſions, as great as thoſe of the firſt fit, if not greater. When 7 min. from the beginning of the exhauſtion were compleated, we let in the Air; upon which the little creature, that ſeemed ſtark dead before, made us ſuſpect that he might recover; but though we took him out of the Receiver, and put *Aqua vitæ* into his mouth,yet he irrecoverably dyed in our hands.

Theſe tryals may deſerve to be proſecuted with further ones, to be made not only with ſuch Kittens,but with other very young Animals of different kinds; for by what has been related it appears, that thoſe Animals continued 3 times longer in the Exhauſted Receiver, than other Animals of that bigneſs would probably have done.

The V. Tittle.

Some tryals about the Air uſually harboured and concealed in the Pores *of Water*, &c.

IT might aſſiſt us to make the more rational conjectures about the Phænomena of divers of our Experiments, if we knew (ſomething near) what quantity of Aërial ſubſtance is uſually found in the liquors,we imploy about them,eſpecially in that moſt common of them,*Water*.And therefore,though it be very difficult, (if at all poſſible) to determine the proportion of the Air, that lurks in water, with any thing of certainty, many circumſtances making it ſubject to vary very much; yet to make the beſt eſtimate, I eaſily could, where none at all that I know of hath been hitherto made by any man, I conſidered, that it might afford us ſome light, if we diſcovered at leaſt what proportion, as to bulk, the Air latitant in a quantity of water would have to the liquor it came from, when the Aërial particles ſhould be gathered together into one place. For,though about this union,and the Spring that may be conſequent to it, ſome doubts may be ſuggeſted, which I have not now time to diſcuſſe; yet I ſuppoſed, that at leaſt ſome diſcoveries would by this way be made, though not of the true proportion between the Air and the Water, yet about two or three particulars, in due time to be taken notice of.

To find Inſtruments, which would any way accommodate our purpoſe, proved a very difficult work; ſo that among other things, that we were fain to do, this was one, that to evince how little the Air, latitant in water, did appear to leſſen the bulk of that water, if it were ſuffered to flye away in an open Tube; we ſuffered it to eſcape in an exhauſted Receiver without any artifice to catch it; by which tryal the water did not part with any thing of its bulk, that made a diminution ſenſible to the eye. Wherefore we endeavoured to make this loſs viſible by ſome other tryals, of which I can find but a few haſty memorials among my loſe Entryes.

A Chymical pipe ſealed at one end, and 36 inches (or ſomewhat leſs) in length, was fill'd with water, and inverted into a glaſs veſſel, not two inches in diameter, and but $\frac{1}{4}$ of an inch or little more in depth. Theſe glaſſes being conveyed into a fit Receiver, and the Air being leiſurely pumped out, and ſomewhat ſlowly readmitted, the numerous bubbles, that had aſcended during the operation, conſtituted at the top an Aërial Aggregate, mounting to $\frac{8}{16}$ wanting about 100 part of an inch.

Theſe are two Experiments.

Preſently after, the Tube (by and by to be deſcribed) was filled again with the ſame water, and inverted, and the water being drawn down to the ſurface of the veſſelled water, and the Air let in again, the water was impelled up to the very top within a 1*0th.* and half a tenth of an inch.

The Tube for meaſuring the Air latitant in water was $43\frac{1}{2}$ inches above the ſurface of the ſtagnant water: the Air collected out of the bubbles at the top of the water, was the firſt time $\frac{1}{4}$ of an inch and ſomewhat better; the ſecond time we eſtimated it but $\frac{1}{8}$ and $\frac{1}{16}$. The firſt time the water in the pipe was made to ſubſide full as low as the ſurface of the reſtagnant water: the ſecond time the loweſt, we made it ſubſide, ſeemed to be 4 or 5 inches above the ſurface of the water in the open veſſel.

Matter of *fact* thus recited would afford divers difficulties worthy to be conſidered, which I have not leiſure to diſcuſſe; eſpecially the Odd thing that happens to the Aërial particles of water: For though, whilſt they lay concealed in the water, they took up ſo little room in it, that it was inſenſible, and when they were permitted to eſcape out of the Tube, the water was not manifeſtly diminiſhed by their receſſe; yet when they were aſſociated at the top of the Tube, their aggregate did ſometimes maintain a place, that was conſiderable enough in reference to the capacity of the whole Tube; though I muſt here advertiſe, that this Aggregate did at the top of the Tube poſſeſs more room than its bulk did abſolutely require, becauſe it was ſomewhat defended from the preſſure of the Atmoſphere by the weight of the ſubjacent Cylinder of water, which might be about three or four foot long.

Quere: Whether any conſiderable proportion of Bubbles will be afforded by the ſame liquor, if it be ſuffered to continue in the glaſs for ſome competent time, after it has been once, or oftener, freed from bubbles already?

Quere: How far it may be worthy our conſideration, whether in common water there may not be concealed Air enough to be of uſe to ſuch cold Animals as *Fiſhes*; and whether it may be ſeparable from the water, that ſtrains through their gills?

But though I was at firſt content to make uſe of this way of eſtimating the Air concealed in water, yet when I came where I could be a little better accommodated with glaſſes, I bethought my ſelf of a ſmall Inſtrument, that would much better diſcloſe the wonderful plenty of the Aërial particles I deſigned to diſcover. The ſtructure and uſe of this Glaſs may be eaſily enough underſtood by the recital of the firſt Experiment, that was made with it, whereof take the following *Tranſcript*.

We provided a clear round Glaſs, furniſhed with a pipe or ſtem of about 9 inches in length, the globulous part of the glaſs being on the outſide about 3½ inches in diameter; the Pipe of this glaſs was within an inch of the top, melted at the flame of a Lamp, and drawn out for two or three inches as ſlender as a Crow's-quill, that the decrement of the water upon the Receſſe of the Air, harboured in its pores, might, if any ſhould happen, be the more eaſily obſerved and eſtimated. Above this ſlender part of the Pipe, the Glaſs, as was before intimated, was of the ſame largeneſs (or near it) with the reſt of the Pipe, that the Aerial bubbles, aſcending through the ſlender part, might there find room to break, and ſo prevent the overflowing, or loſs of any part of the water.

This Veſſel being not without difficulty and ſome Induſtry filled, till the liquor reached to the top of the ſlender part, where not being uniformly enough drawn out,it was ſomewhat broader than elſewhere; we conveyed the Glaſs, together with a pedeſtal for it to reſt upon, into a tall Receiver, and pumping out the Air, there diſcloſed themſelves numerous bubbles aſcending nimbly to the upper part of the Glaſs, where they made a kind of froth or foam; but by reaſon of the above-mentioned figuration of the Veſſel, they broke at the top of the ſlender part, and ſo never came to overflow.

This done, the pump was ſuffered to reſt a while, to give the Aerial particles, lodged in the water, time to ſeparate themſelves and emerge, which when they had done a pretty while,the pump was plyed again, for fear ſome Air ſhould have ſtolen into ſo large a Receiver. Theſe viciſſitudes of pumping and reſting laſted for a conſiderable time, till at length the bubbles began to be very rare, and we weary of waiting any longer; ſoon after which the external Air was let into the Receiver, and it appeared ſomewhat ſtrange to the Spectators, that notwithſtanding ſo great a multitude of Bubbles, as had eſcaped out of the water, I could not by attentively comparing the place where the ſurface of the water reſted at firſt (to which a mark had been affix'd) with that where it now ſtood, I could not, I ſay, diſcern the difference to amount to above, if ſo much, as an hairs breadth; and the chief Operator in the Experiment profeſſed that, for his part, he could not perceive any difference at all.

Thus far for the Narrative of the tryal made by *Water*; but that was not the only Liquor, into whoſe Aerial particles I deſigned by our little Inſtrument to enquire; and therefore filling a Glaſs of the ſame ſhape, and much of the ſame bigneſs, with *Claret wine*, and placing it upon a convenient Pedeſtal in a tall Receiver,we cauſed ſome of the Air to be pumped out; whereupon in a ſhort time there emerged, through the ſlender Pipe, ſo very great a multitude of Bubbles, that were darted,as it were, upwards, as did not a little both pleaſe and ſurprize the Beholders: but it forced us to go warily to work, for fear the Glaſs ſhould break, or the wine overflow. Wherefore we ſeaſonably left off pumping, before the Receiver was any thing near exhauſted, and ſuffered the Bubbles to get away as they could.

till the preſent danger was overpaſſed, and then from time to time we pump'd a little more Air out of the Receiver, till we were weary, the withdrawing of a moderate quantity of Air at a time ſufficing, even at the latter end, to make the Bubbles not only copiouſly, but very ſwiftly aſcend,(by a minute Watch) for above a quarter of an hour together.

The little Inſtrument, made uſe of about theſe tryals, being deſigned to examine, among other things, the quantity of Bubbles lurking in ſeveral Liquors, is to be applyed to *Spirit of Wine* and *Chymical Oyles*, that are more ſubtil Liquors than Wine it ſelf. And ſome circumſtances of our tryals made us think, that it might be worth examining, what kind of ſubſtance may be obtained by this way of handling Aerial and Spirituous Corpuſcles. But of the other uſes of our Inſtrument elſewhere.

The VI. Title.

Of ſome Phænomena, afforded by Shell-Fiſhes *in an exhauſted Receiver.*

Experiment the 1.

AN *Oyſter* being but into a very ſmall Receiver, and kept in long enough to have ſucceſſively kill'd three or four Birds or Beaſts, *&c.* was not thereby kill'd, nor, for ought we could perceive, conſiderably diſturb'd; only at each ſuck we perceiv'd, that the Air contain'd between the two Shells broke out at their Commiſſure; as we concluded from the foam which at thoſe times came forth all round that Commiſſure. About twenty four hours after, coming to ſee in what condition this Oyſter was, I found, that both this, and another that had been put at the ſame time into the Receiver, were alive; but how long afterwards they continued ſo, I did not obſerve.

Experiment the 2.

That ſame day we put a pretty large *Craw-Fiſh* into a pretty large Receiver, and found, that though he had been injur'd by a fall before he was brought thither, yet he ſeem'd not to be much incommoded by being included, till the Air was in great meaſure pump'd out, and then its former motion preſently ceaſed, and he lay as dead; till, upon the letting in a little Air into the Receiver, he began fortwith to move a freſh. And upon the withdrawing the Air again, he preſently, as before, became moveleſs. Having repeated this tryal two or three times, we took him out of the Receiver, where he appear'd not to have ſuffer'd any harm.

Experiment the 3.

But I thought it not unlikely, that there may be ſome ſuch inequality in the ſtrength or vivacity of Animals, as to ſuch kind of Experiments as ours, that it might be well worth while in ſeveral caſes to reiterate our Tryals. And on this occaſion I ſhall here add, that having put an *Oyſter* into a viol full of Water, before we included it in the Receiver, that through the liquor the motion of the Bubbles, expected from the Fiſh, might be the more pleaſantly ſeen and conſider'd; this Oyſter prov'd ſo ſtrong, as to keep it ſelf cloſe ſhut, and repreſs'd the Eruption of the Bubbles, that in the other did force open the ſhells from time to time; and kept in its own Air as long as we had occaſion to continue the Tryals.

Experiment the 4th.

Moreover a *Craw Fiſh*, (that was thought more vigorous,) being ſubſtituted in the place of the former Craw-Fiſh, though once he ſeem'd to loſe his motion together with the Air, yet afterwards he continued moving in the Receiver, in ſpight of our pumping: Whether becauſe there was ſome unperceiv'd leaking, that hindred a ſufficient Exhauſtion of the Air, or becauſe this particular Animal was more ſtrong or vivid than the other, we could not poſitively determine.

The VII. Title.

Of the Phænomena of a Scale-Fiſh *in an Exhauſted Receiver.*

THe following Experiment is far from being the firſt that was made on a Scale-Fiſh in our *Vacuum*; but in regard that the Receivers, wherein thoſe tryals were made, the External Air could not be kept out near ſo long, and ſo well as in the Veſſel I am about to mention, I judg'd it well worth the pains to obſerve, what would happen to a Fiſh in an exhauſted Veſſel, where it ſhould be kept for ſome hours together from all ſupply of freſh Air. And therefore I made ſeveral Tryals to that purpoſe; whereof that, which I think the moſt conſiderable, was Regiſtred as follows:

We took a Receiver ſhap'd almoſt like a Bolthead, containing by eſtimation near a Pint; and the Globulous part of it being almoſt half full of water, we put into it, at the *Orifice* (which was pretty large) a ſmall *Gudgeon*, about three Inches long, which when it was in the Water ſwam nimbly up and down therein. Then having drawn out the Air ſo well, that we gueſs'd by a Gage, that about nineteen parts of twenty or more might be exhauſted, we ſecur'd our ſelves, that the regreſs of the Air ſhould not injure our Experiment; about which we obſerv'd theſe particulars.

Firſt, The neck of the Glaſs being very long, though there appeared great ſtore of Bubbles all about the Fiſh; yet the reſt of the Water, notwithſtanding the withdrawing of ſo much Air as has been mention'd, emitted no froth, and but few Bubbles.

Secondly, The Fiſh both at his mouth and gills did, for a great while, diſcharge ſuch a quantity of Bubbles as appear'd ſtrange, and for about half an hour or more (for much longer I had not opportunity to watch it;) when ever he reſted a while, new Bubbles would adhere to many parts of his Body (as if they were generated there) eſpecially his Fins and Tayle: So that he would appear almoſt beſet with Bubbles; and if, being excited to ſwim, he was made to ſhake them off, he would quickly, upon a little Reſt, be beſet with new ones as before.

Thirdly, Almoſt all the while he would gape and move his Gills, as before he was included; though towards the end of the time that I watch'd, it often happen'd, that he neither took in, nor emitted any Aerial particles that I could perceive.

Fourthly, After a while he lay almoſt conſtantly with his Belly upwards, and yet would in that poſture ſwim briſkly as before.

Fifthly, Nay after a while he ſeem'd to be more lively than at firſt putting in; whether by reaſon, that by diſcharge of ſo many Bubbles, which by their diſtenſion perhaps put him to pain, he found himſelf reliev'd, or for ſome other cauſe, I examine not.

Having occaſion to go abroad, I return'd about an hour and a half after he had been ſeal'd up, and found him almoſt free from Bubbles, and with his Belly upwards, and ſeeming ſomewhat tumid, but yet lively as before. But an hour and a quarter after that, when riſing from dinner I went to look upon him again, he ſeem'd to be moveleſs and ſomewhat ſtiff; yet upon ſhaking the Glaſs, obſerving ſome faint ſigns of life in him by ſome Languid motions, he attempted to make when excited to them, I open'd the Receiver under water, to try if that Liquor and Air would recover him; and the external water ruſhing in till it had fill'd the vacant part of the Ball and the greateſt part of the ſtem too, the Fiſh ſunk to the bottom of it, with a greater appearance than ever of being alive; in which ſtate after he had continu'd a pretty while, I made a ſhift, by the help of the water he ſwam in, to get him through the Pipe into a Baſon of water, where he gave more manifeſt ſigns of life: but yet for ſome hours lay on one ſide or other, without being able to ſwim or ly on his belly, which appear'd very much ſhrunk in, as if ſomething during the time of its being ſeal'd up had been broken in his body, or his Belly had been exceedingly diſtended, beyond reſtitution to its former Tone.

All the while he continued in the Baſon of water, though he mov'd his Gills as before he had been ſeal'd up; yet I could not perceive, that he did, even in his new water, emit, as formerly, any Bubbles, though two or three times I held him by the Tayl in the Air, and put him into the Water again; where at length he grew able to lye conſtantly upon his Belly (which yet retain'd much of its former lankneſs;) and though it be now about or above twenty four hours ſince he was firſt included, he continues yet alive.

(*Poſtſcript.* He liv'd in the Baſon eight or ten dayes longer; though divers Gudgeons ſince taken dy'd there in much fewer dayes.)

The VIII. Title.

Of two Animals included, with large wounds in the Abdomen, in the Pneumatical Receiver.

Experiment the 1.

*Sept.*12. A Small *Bird*, having the Abdomen opened almoſt from flank to flank, without injuring the Guts, was put into a ſmall Receiver, and the Pump being ſet a work continued for ſome little time without giving any ſigns of diſtreſs, but at the end of about a minute and an half from the beginning of the exhauſtion, ſhe began to have convulſive motions in the wings; and though the convulſions were not univerſal, or did appear violent, as is uſual in other Birds from whom the Air is withdrawn by the Engin, yet at the end of two full minutes, letting in the Air, and then taking off the Receiver we found the Bird irrecoverable; notwithſtanding which we did not find any notable alteration in the Lungs, and found the Heart (or at leaſt the Auricles of it) to be yet beating, and ſo it continued for a while after.

Experiment the 2.

We took alſo a pretty large *Frog*, and having without violating the Lungs or the Guts made two ſuch inciſions in the Abdomen, that the two curled bladders or lobes of the Lungs came out almoſt totally at them, we ſuſpended the Frog by the legs in a ſmall Receiver, and after we had pumped out a good part of the Air, the Animal ſtrugled very much, and ſeemed to be much diſordered, and when the Receiver was well exhauſted, ſhe lay ſtill for a while as if ſhe had been dead, the Abdomen and thigh very much ſwelled, as if ſome rarified Air or Vapor forcibly diſtended them. But as, when the Frog was put in, one of the Lobes was almoſt full, and the other almoſt ſhrunk up, ſo they continued to appear, after the Receiver had been exhauſted; but upon letting in of the Air, not only the body ceaſed to be tumid, but the plump bladder appeared for a while ſhrunk up as the other, and the Receiver being removed, the Frog preſently revived, and quickly began to fill the Lobe again with Air.

The ſame day.

The IX. Title.

Of the motion of the ſeparated Heart of a Cold Animal in the Exhauſted Receiver.

Without diſcuſſing the opinions of Learned men about the connexion and dependency of the Motion of the Bloud, and Beating of the Heart, I thought, it might give me a ſufficient inducement to make the following Experiment, that ſeveral ſorts of Animals would be preſently killed in our *Vacuum* by the withdrawing of the Air, and even the Inſects mentioned in the formerly publiſhed *Digreſſion* about Reſpiration, though they alſo were not totally deprived of *life* by the abſence of the Air, yet they were of *viſible motion*: Wherefore ſome good hint or other being to be hoped for from the diſcovering, whether or no a ſeparated Heart, which is but a part of an Animal, would continue its motions in our *Vacuum*; we made ſome tryals to that purpoſe, whoſe ſucceſs I find thus ſet down.

Experiment the 1.

The Heart of an *Eele* being taken out and laid upon a plate of Tin in a ſmall Receiver, when we perceived it to beat there as it had done in the open Air, we exhauſted the Veſſel, and ſaw, that, though the heart grew very tumid, and here and there ſent forth little Bubbles, yet it continued to beat as manifeſtly as before, and ſeemed to do ſo more ſwiftly; as we tryed by numbring the pulſations it made in a minute, whilſt it was in the exhauſted Receiver, and when we had readmitted the Air, and alſo when we took it out of the Glaſs, and ſuffered it to continue its motion in the open Air. The heart of an other Eele, being likewiſe taken out, continued to beat in the emptied Receiver, as the other had done.

Experiment the 2.

The Heart of an other Eele, after having been included in a Receiver firſt exhauſted, and then accurately ſecured from leaking, though it appeared very tumid, continued to beat there an hour; after which looking upon it and finding its motion very languid, and almoſt ceaſed, by breathing a little upon that part of the glaſs where the heart was, it quickly regained motion, which I obſerved a while; and an hour after finding it to ſeem almoſt quite gone, I was able to renew it by the application of a little more warmth. At the end of the third hour, coming to look at it once more, a bubble, that appeared to be placed between the Auricle and the Heart, ſeemed to have now and then a little trembling motion; but I found it ſo faint, that I could no more by warmth excite it, ſo as plainly to perceive the heart to move: wherefore I ſuffered the outward Air to ruſh in, but could not diſcern, that thereby the heart regained any ſenſible motion, though aſſiſted with the warmth of my breath and hands.

The X. Title.

A Compariſon of the Times wherein Animals may be kill'd by Drowning, or withdrawing of the Air.

TO help my ſelf and others to judge the better of ſome difficulty's concerning Reſpiration, I thought it might be uſeful, that we compar'd together the Times, wherein Animals may be kill'd by *that want* of Reſpiration, which in thoſe that are drown'd is cauſed by the water that ſuffocates them, and *that other* want, which proceeds from withdrawing the ambient Air. Of the *latter* of theſe a ſufficient number of Inſtances is to be met with among our other Experiments, and therefore I ſhall now ſubjoyn about the *former* the more Tryals, becauſe this Compariſon hath not, that I know of, been yet thought on by any.

Experiment the 1.

Sept. 10. A *Green-Finch*, having his legs and wings tyed to a weight, was gently let down into a glaſs-body fill'd with water; the time of its total immerſion being mark'd : At the end of half a minute after that time the ſtruglings of the Bird ſeeming finiſh'd, he was nimbly drawn up again, but found quite dead.

Experiment the 2.

Whereupon a *Sparrow*, that was very luſty and quarrelſome, was ty'd to the ſame weight, and let down after the ſame manner; but though he ſeem'd to be under water more vigorous than the other Bird, and continued ſtrugling almoſt to the very end of half a minute from the time of his being totally immers'd (during which ſtay under water there aſcended from time to time, pretty large bubbles from his mouth,) yet notwithſtanding, that as ſoon as ever the half minute was compleated, he was drawn up, we found him, to our wonder, irrecoverably gone.

Experiment the 3.

A ſmall *Mouſe*, being held under water by the tail, emitted from time to time divers Aerial Bubbles out of his mouth; and at laſt, as one of the Spectators affirm'd, he ſaw at one of his Eyes, being taken out at the end of half a minute and ſome few ſeconds, he yet retain'd ſome motions; but they prov'd but Convulſive ones, which at laſt ended in Death.

By what is related under the I. Title, *it does not appear, that* Water-Fowl, *at leaſt that* Ducks *could in our Receivers endure the want of Air much longer than other Birds: But now to ſhew, that the Contrivance of Nature is not inſignificant, as to the enabling them to continue much longer under Water, without freſh Air, than the* Land-birds *abovemention'd, it will not be amiſs, to ſubjoyn the two following Experiments.*

Experiment the 4th.

We took the *Duck* mention'd in the *I. Title*, and ſo ty'd a conſiderable weight of Lead to her body, as it did not hinder her Reſpiration, and yet would be ſure to keep her down under water; which we had found that a ſmall weight would not do by reaſon of her ſtrength, nor yet a great weight, if ty'd only to her feet, in ſuch a middle-ſiz'd Tub as ours was, becauſe of the height of her neck and beak. With the above-mention'd Clog, the Duck was put into a Tub full of clear water, under whoſe Surface ſhe continued, about a minute by my Watch, quietly enough, but afterwards began to appear for a while much diſturb'd; which fit being over, our not perceiving any motion in her made us, at the end of the ſecond minute, take her out of the water, to ſee in what condition ſhe was, and finding her in a good one, after we had allowed her ſome breathing time to recruit her ſelf with freſh

Air,

Air, we let her down again into the Tub, which in the mean time had been fill'd with freſh water, leaſt the other, which had been troubled with the ſteams and foulneſs of the Ducks Body, might either haſten her death by its being infected with them, or hinder our diſcerning what ſhould happen, by its being opacated by them.

The Bird being thus under water did, after a while, begin, and from time to time continue, to emit divers Bubbles at her Beak. There alſo came out at her Noſtrils divers real Bubbles from time to time; and when the Animal had continued about two minutes or better under water, ſhe began to ſtruggle very much, and to endevour either to emerge or chang Poſtures; the latter of which ſhe had liberty to do, but not the former. After four minutes, the Bubbles came much more ſparingly from her: then alſo ſhe began to gape from time to time, (which we had not obſerv'd her to do before,) but without emitting Bubbles; and ſo ſhe continued gaping till near the end of the ſixth minute, at which time all her motions, ſome of which were judg'd convulſive, and others that had been excited by our rouzing her with a *forceps*, appear'd to ceaſe and her head to hang careleſly down, as if ſhe were quite dead. Notwithſtanding which, we thought fit for greater ſecurity to continue her under water a full minute longer, and then finding no ſigns of life, we took her out, and being hung by the heels, and gently preſs'd in convenient places, ſhe was made to void a pretty quantity of water, of which whether any had been receiv'd into the Lungs themſelves, we had not time and opportunity to examine. But all the means, that were to recover the Bird to life, proving Ineffectual, we concluded, ſhe had been dead a full minute before we removed her out of the water: So that, to ſum up the Event of our Experiment, even this Water-Bird was not able to live in Cold water, without taking in freſh Air, above ſix minutes; which is but $\frac{1}{10}$ of an hour.

Experiment the 5th.

The *Duckling* mention'd in the *I. Title* and *ſecond Experiment*, having a competent weight tyed to her legs, was let down into a Tub of Water which reached not above an inch or two higher than her Beak: during the moſt part of her continuance, there came out ſtore of Bubbles at her Noſtrils, but there ſeem'd to come out more and greater, from a certain place in her head almoſt equidiſtant from her eyes, but ſomewhat leſs remote from her Neck than they. Whilſt ſhe was kept in this condition, ſhe ſeem'd frequently to endeavour to dive lower under water, and after much ſtrugling and frequent gaping, ſhe had divers convulſive motions, and then let her Head fall down backward, with her Throat upwards. To which moveleſs poſture ſhe was reduc'd at the end of the third minute, if not a little ſooner; but a while after there appear'd a manifeſt but tremulous motion in the two parts of her Bill, which continued for ſome time, but afforded no Circumſtances, whereby by we could be ſure, that they were not Convulſive Motions; but theſe alſo ceaſing upon the end of the fourth minute, the Bird was taken out and found irrecoverable.

Experiment the 6th.

A *Viper* that was kept ſo many hours in an Exhauſted Receiver, till it was concluded to be ſtark dead, and to have been ſo for a good while, was nevertheleſs reſolutely hindered by me from being thrown away, till I had try'd, what could be done by keeping it all night in a glaſs-body upon a warm digeſtive Furnace. Whereupon this Viper was found the next morning not only to be reviv'd, but to be very lively, ſo as to invite me to make with Her, without ſeeking for another, the following Experiment.

We put her into a tall Glaſs-body, fitted with a Cork to the Orifice of it, and depreſs'd with weight, ſo that ſhe could come at no Air. In this caſe we obſerv'd her from time to time; and after ſhe had been duck't a while, ſhe lay with very little motion for a conſiderable ſpace of time. At an hour and a quarter ſhe often put out her black tongue: at near four hours ſhe appear'd much alive, and, as I remember, about that time alſo put out her tongue, ſwimming all this while, as far as we obſerv'd, above the bottom of the water. At the end of about ſeven hours or more, ſhe ſeem'd yet to have ſome life in her, her poſture being manifeſtly chang'd in the Glaſs, from what it was a while before; unleſs that might proceed from ſome difference made in her Body as to Gravity and Levity. Not long after ſhe appear'd quite dead, her head and tayl hanging down moveleſly, and directly towards the bottom of the veſſel, whilſt the middle of the Body floated as much as the above-mention'd Cork would permit it.

Haſte maketh me pretermit the mention of divers things ſuggeſted by what hath been delivered upon the preſent *Title*. But this one thing would be taken notice of, that, though ſome of the abovementioned Animals ſeem, by the Relations we have given of them, to have been a little ſooner deſtroyed by drowning, than any we have mentio'nd were by our Engin, that is no ſure proof, that ſuffocation does kill Animals faſter, than the deprivation of Air, they are expoſed to in our Engin. For in drowning, that which deſtroys is applyed to its full vigour at the very firſt, and all at once; whereas, our Receivers being made for ſeveral purpoſes, the Deprivation of the Air, that they make, cannot be made all at once, but the Air muſt be pump't out by degrees; ſo that till the laſt the Receiver will be but partly emptied. For confirmation of which, I have this to alledge, that, having in the preſence of ſome *Virtuoſi* provided for the nonce a very ſmall Receiver, wherein yet a Mouſe could live ſometime, if the Air were left in it, we were able to evacuate it at one ſuck, and by that advantage we were enabled, to the wonder of the Beholders, to kill the Animal in leſs than half a minute.

An Accompt of *Three* Books.

I. *De ANGLORUM GENTIS ORIGINE DISCEPTATIO, Auth.* Rob. Sheringhamo *Cantabrigienſi, Colleg. Gonvilii & Caii Socio.* Cantabrigiæ, 1670. in 8°.

THe Learned Author of this Diſcourſe doth therein inquire into the Origine both of the Antient *Britains*, and of the *Angli* or *Engliſh*; having firſt deſcribed the Scituation, Latitude, Form, Fertility, and Temper of the Inhabitants of this *Iſland*. In his Inquiry he finds nothing that may be more certain in ſo great obſcurity, than that the Old *Britains* were deſcended from the *Trojans*, by *Brutus*, the Off-ſpring of *Æneas*; and that the *Angli* are the Race of the *Gothick* Nation (which he maketh the Off-ſpring not of *Japhet*, but of *Sem*:) Further, that the *Getæ* or *Goths* did paſs through *Scythia* into *Scandia* and *Sarmatia*, and from *Scandia* into the Iſles of the *Baltick* Sea and *Germany*; but that under that great Captain *Filemer* they made an Excurſion again into *Aſia*, and having there ejected out of their Seats the *Magogæan Scythians* and the *Cimmerians*, ſetled themſelves and their Empire in *Aſia*; whence the *Saxons*, *Getes* and *Angles*, (the Fore-Fathers of the Engliſh) were brought back again into *Germany*, to the Antient Seat of the *Getes*, under the Conduct of that Famous *Woden* (the Progenitor of the chief Kings of *Europe*) about the year 2910. All which, and much more our Author renders very probable, and in doing ſo, gives proof of much Learning and Induſtry.

II. *A Vindication of HYDROLOGIA CHYMICA, by* William Sympſon *M. D. London, for* R. Chiſwell *in Little Britain*, 1670.

THis Author, eſteeming, that his Antagoniſt, Dr. *Wittie*, hath fallen ſhort in ſtrength of Argument againſt his firſt Book, written upon the *Scarborough-Spaw*, and made ſupplies by groundleſs accuſations, maketh it his buſineſs in this Reply, to Anſwer the moſt material Objections urged againſt him, endeavouring to confirm what he had ſaid before, and adding new Obſervations.

And for a further Diſcovery of the nature of the other Medicinal Waters at *Knaresborough*, he gives a particular Diſcourſe both of the *Sweet-Spaw*, and *Sulphur-Well*, found there; where he propounds ſome Experiments, which, in the Authors opinion, not only demonſtrate the Nature and Eſſence of their conſtitutive Ingredients, but by which alſo any *Simple Spring-Water* may be changed into an *Artificial* Mineral

Water, of the ſame taſt and operation with the *Natural.* And as to the Experiments, which concern the *Sulphur-Water*, and conſequently all other the like *Sulphur-Springs*, he affirms them to be ſuch, as no Author, that he knows, hath taken notice of, believing alſo, that they may yield no very ſmall light for the further advancement of Sulphurous and other Mineral Waters.

And foraſmuch as the Eſſence of the *Scarbrough-Spaw* conſiſts, in his opinion, moſtwhat of an *Aluminous* Salt, he thence, taketh occaſion to give an Accompt of the *Alome-Works* at *Whitby*; deſcribing alſo the Difference betwixt the Natural and Factitious Alome.

To all which he annexeth; *Firſt*, A return to ſome *Queries*, formerly propounded in *N°*. 52. of theſe *Tracts* by D. *Dan. Foot*, concerning Mineral Waters. [Where the Reader is deſired to take notice of the great miſtake of Dr. *Sympſon*, in calling theſe Papers the *Ph. Tranſactions of the R. Society*; which is a great injury to that Illuſtrious Body, theſe Tracts being only the Communications of a ſingle Perſon, who hath alſo heretofore expreſly ſignified ſo much to the World *N°*. 11. of theſe Books; and ſtill ſignifieth the like at the end of every year, in the ſeveral Dedications of the ſame.] *Secondly*, Some Reflexions upon the moſt material Paſſages and Experiments, in a late Treatiſe, printed in *London*, and Entitul'd, *Scarbrough Spaw*, *Spagyrically anatomized by* Dr. *G. Tonſtal*: in which Reflexions, a way is propounded for preventing all Inconveniencies, which may happen to thoſe that drink the ſaid *Spaw*. *Thirdly*, An Examination of the *German Spaw-Water*, as he found ſome of it ſeal'd up in Bottles in *Holland*. *Fourthly*, Some Obſervations on a Diſſected Woman, who dyed of the *Jaundice*.

Through the whole Book are to be met with, divers Obſervations, Experiments, and Hints, which may give occaſion to the *Reader* to improve the ſeveral Subjects, which they relate to. Among other particulars, he inſinuates, that he knows, by a *Diſſolvent*, not rare among Chymiſts, with the addition of a Man's breath, to calcine a Metal, *viâ humidâ*, without which (or ſomething equivalent thereto) the humid Calcination of that Metal cannot be perform'd; *item*, How to melt another Metal (prepared after a certain manner) with the help of one ſingle Lamp, un-aſſiſted by any blaſt; *item*; That ſome *Menſtruum's* may diſſolve or break in pieces the cloſe riveted parts of compact Bodies, when yet they leave other Bodies of a ſofter and ſlighter texture untouch't: which, he adds, giveth light to the poſſibility of finding out by Art ſuch *Menſtruum's*, as may diſſolve and comminute the hard Stone in the Bladder, without touching the ſoft membrane of it, and other entrals: *Item*, That not only *Niter* is afreſh to be got out of the ſame Earth, it was formerly extracted from; but the like is obſerv'd in the Minerals of *Vitriol* and *Alome*; and, which is more, that the Generation of Metals is not terminated with one production, the Tinners in *Cornwal* having found after 30 years, *Tin* generated anew, where it hath been formerly digg'd up and fill'd with Earth. *Item*, That taking a pint of ſimple Spring-water, in which he diſſolv'd betwixt one and two drachms of Sal marine in *Frigido* (ſince about that quantity of Common Salt the *Sulphur-water* in the North contains,) he added to this Solution of Salt in water, about two or three ounces of *Calx Vive* and the Marcaſites of *Vitriol* (found near the *Sulphur-Well*) groſly pulverized; which preſently became conſiderably hot: whereupon pouring off ſome of the Water, he poured into the ſame, filtred, a little Solution of the ſimple *Alome*-Salt; and it immediately cauſed a precipitation of a Sulphur, and ſent forth the very ſmell, and had alſo the exact taſt of the *Sulphur-Well.*

Again; That, ſeeing all Bodies are but Concretions and Hardnings of their primitive Juyces, under various diſguiſes, generally perform'd by the operation of the Air, therefore the Preparation of a Diſſolvent by Art, (which may work wonders in this kind) is no more, to him, than to make ſuch an one, as may ſoften theſe Concretions, made by the Air, and by taking away their hardneſs, reduce them into their firſt Juicy Liquors. Where he obſerveth, that if it were not for the perpetual Circulation of the Juyces in the Body, conſtantly tranſpiring through the pores thereof, we ſhould either become petrified, or be incircled with a Bark.

III. *A Diſcourſe in Vindication of* Des-Cartes's *Syſteme, by* M. Des-Fourneillis: *to which is annexed the* SYSTEME GENERAL *of the ſame* CARTESIAN *Philoſophy, by* Francis Bayle, *M. D. at* Toloſe. *Printed at* London *for* Moſes Pit, *in Litle-Britain.*

Both theſe Tracts were lately *Engliſh't* out of *French*: Of the *latter* of which, whilſt it was yet un-tranſlated, ſome Accompt was given in *Numb.* 54: the *former* ſhews only, that the Syſteme of *M. Des-Cartes* ſeems to have been taken out of the firſt Chapter of *Geneſis*; and particularly, that his Opinion concerning *Brutes* contains nothing dangerous.

Errata.

Pag.2012.l.36.r.*was not yet*, p. 2016.l.18.r.*reſted himſelf*, p.2023.l.19.r. *being put.*

LONDON.

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Numb. 63.

PHILOSOPHICAL TRANSACTIONS.

September 12. 1670.

The CONTENTS.

The Continuation of the Experiments concerning Reſpiration, promiſed in the precedent Tract, and communicated by the ſame Noble Author, in Ten other Titles; viz. Of the Accidents, that happen'd to Animals in Air, brought to a Conſiderable degree of Rarefaction; To which is annex'd a digreſſive Experiment concerning Reſpiration upon very high Mountains. Of the Obſervations produced in an Animal by Changes as to Rarity and Denſity made in the ſelf-ſame Air. Of an unſucceſſfull Attempt, to prevent the Neceſſity of Reſpiration by the Production of Growth of Animals in the Vacuum Boylianum; together with two digreſſive Experiments concerning the Expanſion of Bloud, and other Animal juyces, as alſo other ſoft parts, even in cold Animals. Of the power of Aſſuefaction to enable Animals to hold out in Air, by rarefaction made unfit for Reſpiration. Some Experiments ſhewing, that Air, become unfit for Reſpiration, may retain its wonted Preſſure. Of the uſe of the Air to elevate the Steams of Bodies. Of the long continuance of a Slow-worm and a Leech alive in the Vacuum. Of what happen'd to ſome Creeping Inſects; and of the Phænomena ſuggeſted by Winged Inſects in the ſame. Of the Neceſſity of Air to the motion of ſuch ſmall creatures, as Ants, and even Mites themſelves. An Account of two Books: I. TRACTS written by the Honourable Rob. Boyle, concerning Coſmical Qualities; Subterraneal and Submarine Regions; the Bottom of the Sea; together with an Introduction to the Hiſtory of particular Qualities. II. CATALOGUS PLANTARUM ANGLIÆ, opera Johannis Raji. M.A. è Soc. Regia.

A Preface concerning theſe Experiments.

Though to ſhun prolixity, the Preface, which the Author had made to all he wrote about Reſpiration, have been purpoſely omitted; yet there are ſome few points ſo neceſſary to be taken notice of, that 'tis thought unfit to leave them wholly untouch'd. For, the following Experiments being not at firſt written for the Preſs, and thrown by for many years, till they were very haſtily gather'd together, and in ſome places ſupply'd with others, little leſs haſtily annex'd to make ſome neceſſary ſupplys the Reader muſt not expect in ſuch a Caſuall Tract (which the Author confeſſes to be one of the moſt imperfect and immethodicall of all his compoſures) any thing but Novelty, and Truth, and an Earneſt deſire to be ſerviceable in an Inquiry ſo important to Mankind, to the Curious in general, and eſpecially to Phyſitians, who by the incouraging mention they have made of his former endeavours in this kind, have invited him to add theſe many new Experiments to theſe few they had hitherto exerciſed their Wits upon; And, to leave them the more freedom to do ſo, he purpoſely forbore to confirm, or confute any Hypotheſis, or ſo much as propoſe any of his own; declaring it to be his Aime, not to eſpouſe or make a party, but to communicate to the Curious ſome matters of fact, that are new; and in an hiſtorical way impartially delivered. No more of Preface is now to be added, but that 'tis thought fit, for prevention of Ambiguity, to give this Advertiſement touching the ground of the Title of Vacuum Boylianum, to be met with in theſe Experiments; That as Learned men, both Engliſh and Forreigners, in their writings have famiarly for diſtinction ſake imploy'd the Titles of Machina Boyliana, and Experimenta Boyliana; ſo the Author, that writ theſe, for the moſt part in haſt, and for his own memory, did for diſpatch ſake, call the abſence of the Air procured in his Receivers, our Vacuum; whence by Analogy was fram'd the Vacuum Boylianum, which he therefore thinks the leſs improper, becauſe to call it Vacuum abſolutely, would be judged by many a declaring himſelf a Vacuiſt, who does not yet own the being either of their opinion, or a downright Pleniſt; or elſe he muſt be troubleſome to the Reader and himſelf, by frequently explaining, what ſort of Vacuum he underſtands; whereas he declares once for all, that by the Vacuum Boylianum he means ſuch a Vacuity or Abſence of Common Air, as is wont to be effected or produc'd in the operations of the Machina Boyliana.

The XI. Title.

Of the Accidents that happen'd to Animals in Air brought to a conſiderable degree, but not near the utmoſt one, of Rarefaction.

IN the Generality of our Pneumatical Experiments upon Animals, it ſuited with our purpoſes, to rarifie the Air as much, and for the moſt part as faſt, as we could ; but I had other Tryals in Deſign, wherein an extraordinary degree of Rarefaction, but yet not near the higheſt to which the Air might be brought by our Engin, ſeem'd likelieſt to conduce to my inquiries, and particularly ſeem'd hopefull to afford ſome light in reference to thoſe Diſeaſes and Diſtempers, that are thought primarily to affect the Reſpiratory Organs, or to depend upon ſomething amiſs in Reſpiration.

Wherefore having *Gages*, by the help of which ſuch Experiments might be much better perform'd then elſe they could, I attempted ſeveral of them ; ſome of whoſe ſucceſſes I find in the following Memorials.

Experiment 1.

A *Linote* being put into a Receiver, capable to hold about 4½ pints of water, the Glaſs was well cloſ'd with Cement and a Cover; *Auguſt* 16th. but none of the Air was drawn out with the Engine or otherwiſe. And though no new Air was let in, nor any change made in the impriſon'd Air; yet the Bird continu'd there 3 hours without any apparent approach to death : And though it ſeem'd ſomewhat ſick, yet being afterwards taken out, it recover'd and liv'd ſeveral hours.

Experiment 2.

From the abovemention'd Receiver about half the Air was drawn out, a *Linote* being then in the Glaſs, and in that rarify'd *Auguſt* 18th. Air (which appear'd by a *Gage* to continue in that ſtate) the Bird liv'd an hour and near a quarter before it ſeem'd in danger of death ; after which the Air being let in without taking off the Receiver, ſhe manifeſtly recover'd, and leap'd againſt the ſide of the Glaſs ; being taken out into the open Air ſhe flew out of my hand to a pretty diſtance.

Experiment 3.

We convey'd into a Receiver, capable to hold about 4½ pints of water, a *Larke*, together with the *Gage*, by the help whereof we pump'd out of the Receiver ¾ of the Air that was in it before ; then *Septemb.* 9th. heedfully obſerving the Bird, we perceived it to pant very much, ſo that a Learned Phyſitian (from whom I yet diſſented,) judg'd thoſe beatings to be Convulſive : Having continu'd thus for a little above a minute and a half ; the Bird fell into a true convulſive Motion, that caſt it upon the back. And although we made great haſt to let in the Air ; yet before the Expiration of the Second minute, and conſequently in leſs than half a minute from the time immediately preceding the Convulſion, the Lark was gone paſt all recovery, though divers means were us'd to effect it.

Experiment 4.

Septemb. 9th.

Preſently after we put into the ſame Receiver a *Greenfinch*, and having withdrawn the Air till it appear'd by the Gage there remain'd but half, we preſently began to obſerve the Bird; and took notice, that, within a minute after, ſhe appear'd to be very ſick, and ſhaking her head, threw againſt the inſide of the Glaſs a certain ſubſtance which I took to be Vomit, and which afterwards appear'd ſo; upon this Evacuation the Bird ſeem'd to recover, and continue pretty well (but not without panting) till about the end of the fourth Minute, at which growing very ſick, ſhe Vomited again (ſhaking her head as at firſt,) but much more unqueſtionably then before, and ſoon after, eat up again a little of her Vomit; at which time (whether that contributed to her Recovery or no) ſhe very much recovered. And tho ſhe had, in all, three fits of Vomiting; yet for the laſt ſeven or eight minutes that we kept her in the Receiver, ſhe ſeem'd to be much more lively then was expected: which may in part be attributed to a little Air that by an accident got in, tho it were immediately pump'd out again. At the end of a full quarter of an hour from the firſt Exhauſtion of the Receiver, the Bird appearing not likely to dye in a great while, and the Engine being needed for other Uſes, we took out the Bird and thereby put a period to the Experiment.

Experiment 5.

I now thought it fit to try, Whether, though a Viper would not hold out very many hours in Air brought to as high a Rarefaction, as we could bring it by our Engin, yet to that cold and vivacious Animal, a very ſmall proportion of Air, in compariſon of what was neceſſary to hot Animals, would not ſuffice to keep it alive for a conſiderable time: The Narration of the Experiment I find regiſtred as follows.

April. 12th.

A Viper lately bought of the perſon, that at this ſeaſon uſes to take new ones, almoſt from day to day, was included together with a Gage in a portable Receiver, capable to hold about 3½ pints of water. This veſſel being exhauſted, and ſecured againſt the regreſs of the Air, the impriſoned Animal was obſerved from time to time; and obſerved not only to be alive, but nimbly to put out and to draw back its tongue about 36 hours after it was firſt ſhut up; for which reaſon we continued the Veſſel longer in the ſame ſhady place; where at the end of 60 hours looking upon her, as I was going to bed, ſhe appeared very dull and faint, and not likely to live much longer: And the next morning being by ſome occaſions carried abroad, and coming to look upon the Glaſs preſently after dinner, I found her ſtark dead with her mouth open'd to a ſtrange wideneſs; wherefore ſuffering water to be impelled by the outward Air into the cavity of the Receiver, to obſerve how far that veſſel was then emptied of Air, we found by the water that was driven in, and afterwards poured out again and meaſured, that 4 parts of 5, or rather 5 of 6 of the veſſel'd Air (if I may ſo call that which was ſhut up in the Receiver) had been pump'd out: So that in an

Air ſo rarify'd as to expand it ſelf to 5 or 6 times its former and uſual dimenſions, our Viper was able to live 60 hours, that we are ſure of, and perhaps might a pretty while longer.

A digreſſive Experiment Concerning Reſpiration upon very high Mountains.

TO illuſtrate what I have taken notice of in the Printed Experiments about the unfitneſs for Reſpiration obſerv'd by the learned *Acoſta* in the high mountains of *Pariacaca*, I ſhall here add, what I have had the curioſity and occaſion to learn from divers Travellers, whom I purpoſely conſulted about theſe matters; whereof you will eaſily believe that not many of them have had opportunity to give Accounts. Meeting with an Eccleſiaſtical Perſon that had viſited thoſe high mountains of *Armenia*, (on one of which, becauſe of their height, the Tradition of the Natives will needs have the *Ark* to have reſted;) I ask'd him, whether thoſe Mountains are really ſo high as is given out, and whether at the top of that he viſited he found any difficulty of *Breathing*. To the *firſt* part of which Queſtion he anſwer'd; That they were really exceeding high (which he might well judge of, having been upon ſome of the moſt famous both in *Europe*, *Aſia*, and *Africa*;) and that he could not come to the top, becauſe of the unpaſſable ſnows: And to the *ſecond* part he reply'd, that whileſt he was in the upper part of the Mountain he plainly perceiv'd, that he was reduc'd to fetch his breath much oftner than he was wont, and than he did before he aſcended the Hill, and after he came down from it. And upon my inquiring whether or no that difficulty of breathing might not be accidental, or peculiar to him, he told me that he himſelf having expreſt ſome wonder to find himſelf ſo ſhort-winded, the people told him that 'twas no more than happen'd to them when they were ſo high above the plain; it being a common obſervation among them. And I was the more inclin'd both to make inquiry about theſe matters; and to believe what he ſaid, becauſe what he related of their being cover'd with ſnow, and of an odd Temperature of Air, I had learn'd before from a Travailer of another Nation than this Perſon, and a ſtranger to him.

The ſame Churchman, being ask'd by me, Whether he had not in ſome part of *Europe* made the like obſervation (of the difficulty of breathing) told me, that he had done it upon the Top of a Mountain in the Country of *Sevenes* in or near the Province of *Languedoc*; which may ſerve to confirm what I am about to relate from the mouth of a Learned Travailer, that was upon the Top of one of the *Pyreneans* that is not very remote from the Mountains we ſpeak of.

This Gentleman, who was a perſon Curious and Intelligent, being Brother in Law to one of the chief Lords of thoſe parts, was by him invited, about the beginning of *September* to viſit a neighbouring Mountain, that is at leaſt one of the higheſt of the *Pyreneans*, which is commonly called *Pic de Midi*, upon whoſe Top, (where a Tent was ſpread for them) they ſtay'd many hours. His Anſwers to the other Queſtions I asked him, are elſewhere related: All that concerns this place being that

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I find this ſet down among my Adverſaria; *viz.*[I alſo inquired of him whether they found the Air at the Top as fit for Reſpiration as Common Air, which he told me they did not, but were fain to breath ſhorter, and oftner than uſuall; and becauſe I ſuſpected, that might come from their motion, I ask'd, whether they obſerv'd it to ceaſe, when they came down to the Bottom of the Hill, which he told me they plainly did, beſides that they ſtay'd many hours at the Top, too long to continue out of Breath.

But that I may not here conceal any thing, that may conduce to the Diſcovery of the truth in the matter under conſideration, I ſhall here add, that I did ſometimes think it worth further Inquiry, Whether the Sickneſs, if not alſo the Difficulty of breathing, that ſome have been obnoxious to in the uppermoſt parts of *Pariacacha*, and perhaps ſome other high Mountains, may not be imputed not ſo preciſely to the Thinneſs and Rarity of the Air in places ſo remote from the lowermoſt part of the Atmoſphere, as to exclude certain ſteams of a peculiar nature, which in ſome places the Air may be imbued with? In favour of which ſuſpition I remember, that inquiring once of an intelligent man, who had liv'd ſeveral years in the Iſland of *Teneriffe*, Whether he had been at the Top of the *Pic* of that name, and what he had there taken notice of about the Air? He anſwer'd me, That he had attempted to go up to the Top of the Mountain, but that, though ſome of the Company were able to do ſo, he and ſome others, before they had reached near ſo high, grew ſo ſick upon the operation they felt of the ſharp Air, and Sulphureous exhalatious which infected it, that they were fain to ſtay behind their Companions, he having already found this effect of thoſe piercing ſteams upon his face (which when he made me this relation, was of a fair complexion) that the skin began to be of a pale-yellow, and even his hair to be diſcolour'd.

The XII. Title.

Of the Obſervations produced in an Animal in Changes as to Rarity and Denſity made in the ſelf-ſame *Air.*

In the Experiments hitherto recited, the Animals that were recover'd from a gaſping Condition, have been ſo, by letting in freſh Air upon them, and not the ſame that had been withdrawn from them. Wherefore I thought it very requiſite to try, Whether the ſame portion of Air, without being renew'd, would, by being expanded much beyond its uſual degree, and reduc'd to it, ſerve to bring an Animal to Deaths door, and revive him again; ſince by the ſucceſs of ſuch a Tryal, it would notably appear, that the bare change of the conſiſtence of the Air, as to Rarity and Denſity, may ſuffice to produce the abovementioned Effects.

But to deviſe a way to put this Experiment in practice appear'd no eaſy matter; ſince it required a Receiver that ſhould be tranſparent, & be capable of changing its bulk without ſuffering any Air to get in or out, To ſurmount theſe difficulties, the firſt thing I thought on was, to take a fine limber and clear Bladder of a ſheep or hogg, made more tranſparent by being anointed with Oyl, which was done on the outſide, that the ſmell of it might leſs offend the Animal to be included. Then we clipp'd off as much of the Bladder at the neck, as was judg'd abſolutely neceſſary to make an Orifice capable of letting in a *Mouſe*; that ſort of Animals being, by reaſon of their ſmallneſs, the fitteſt of thoſe furniſh'd with Lungs and hot blood, we conld procure. And whereas it ſeemed very difficult, when the neck of the bladder was cut off, to make up ſo large an orifice without wrinckles, at which the rarified Air may eſcape; to obviate this inconvenience, we provided a round ſtick ſomewhat leſs then the Orifice; that, the wood being laid over with a cloſe and yielding cement, (for, pitch or the like common ſtuff will not alwaies ſerve the turn) we might be able to tye the bladder faſt and cloſe enough upon the thus fitted ſtopple.

And now to reduce theſe things to practice, and by their help make our deſigned Experiment, we included a *Mouſe* into a Receiver made according to this way, leaving in the bladder as much Air, as we thought might ſuffice him for as long a time as the Experiment was to laſt. Then putting this limber or extenſible Receiver, if I may ſo call it, into an ordinary one of Glaſs, and placing this Engine near a window, that we may ſee through both of them; the Air was by degrees pumped out of the external Receiver, (as for diſtinction ſake I ſhall call it,) and thereupon the Air included in the bladder did proportionably expand it ſelf and ſo diſtend the external Receiver, till being arrived at a degree of Rarefaction, which rendred it unfit for the included Mouſes Reſpiration, I perceived, though with ſome difficulty, in this Animal the ſigns of his being in great danger of ſudden death. Whereupon the outward Air, being haſtily let into the external Receiver, compreſſed the ſwelled bladder to its former dimenſions, and thereby the included Air to its former denſity, by which means the fainting *Mouſe* was quickly revived. Having given him ſome convenient time of reſpite, the Experiment was reiterated with the like ſucceſs, and we doubted not but the third tryal, we made, would have ended as the two former did; but that, whileſt we were conſidering of the ſickneſs of the Mouſe, which, by reaſon of ſome opacity that could ſcarce be avoided in the wrinckled bladder, was not, as to its degree, ſo eaſily taken notice of, it grew irrecoverable by the ſubſequent condenſation of the Air.

N.B. The Confirmation of this by further Experiments will properly fall under another Title.

The XIII. Title.

Of an unſucceſsfull Attempt to prevent the neceſſity of Reſpiration by the Production *or* growth *of Animals in our Vacuum.*

Having had frequent occaſions to obſerve, how quickly thoſe Animals, whoſe Blood is actually warm, did expire in our *Vacuum*; and that even thoſe Animals with Lungs, whoſe Blood was actually cold, were not able to live any conſiderable time there; I thought it very well worth while, and yet extreamly difficult, to try, whether there might not be ſome wayes yet unpractiſed, either to make ſuch Animals as Nature endows with Lungs, live without Reſpiration, or at leaſt to bring ſuch *Inſects*, and other Animals, as can already live without Air, to move alſo without it in our *Vacuum*.

Therefore conſidering with my ſelf what happens to *Infants* and other young Animals in the Womb, and even after they come from thence, if they continue to be wrapt up in the *Secundines*; though as ſoon as they are brought into the free Air they may be preſently killed by being kept from breathing: Conſidering alſo, what I elſewhere relate of the ſlow Expiration of a very young *Kitling* in our *Vacuum*; together with the long want of Reſpiration, which Cuſtome enables ſome *Divers* to endure: Conſidering theſe things, I ſay; though I know, that ſomewhat may be objected to ſhew, that theſe Inſtances are not altogether full to my purpoſe; yet they, among other things, invited me to think, that the leaſt unlikely projects, that occurr'd to my barren Invention, would be theſe that follow.

Firſt, I thought fit to try, Whether the *Seeds* of reſpiring Animals might be either hatched or otherwiſe brought to produce Young ones in our *Vacuum*. For, if that could be compaſſed, I ſhould obtain my end.

Next, in caſe of my failing in the former attempt, and that, which is to be after a few Lines propoſed, I thought fit to try, whether at leaſt I could not bring the *Eggs* of Inſects to hatch or be animated; or *Aurelias* (as they call them) that were already alive, turn according to the courſe of Nature, into *Winged Inſects*, as Flies or Butter-fiſhes: (of which tryals and thoſe of the former ſort, the account properly belongs to another place, where I relate the ſucceſs of theſe and other attempts to produce Plants and Animals in our *Vacuum*.)

But *thirdly*, Conſidering that Nature has ſo ordered it, that *Froggs*, though when they are grown big enough to deſerve that name, they be amphibious Animals endowed with Lungs; yet before they attain to that pitch, they live wholy in the water like Fiſhes, I thought it the moſt expeditious and leſt improbable attempt we could make, to try, Whether or no this Animal, being as a Fiſh brought to live either in our *Vacuum*, or at leaſt in highly rarified Air, would not continue to do ſo, after its Lungs ſhould be perfectly formed. Wherefore though I foreſaw and foretold the difficulty, that would be met with in the proſecution of this Experiment, namely that the Aereal Bubbles, that would be diſcloſed in ſuch ſoft Bodies upon the withdrawing of the preſſure of the ambient, would ſo violate the ſlight Texture of thoſe tender Animals, as to hinder them from living long or moving freely; yet I thought it very fit to attempt the Tryal, whereof I find this account among my Adverſaria.

Experiment 1.

We took a good Company of *Tadpoles*, and put them with a convenient quantity of water into a Portable Receiver of a round figure, and obſerved, that at the firſt exuction of the Air they did riſe to the top of the water, though moſt of them ſubſided again, till the next exuction raiſed them. They ſeemed by their active and wrigling motion to be very diſcompoſed. The Receiver being exhauſted, they continued reſtleſs moving all of them in the top of the water, and though ſome of them ſeemed to endeavour to go to the bottom, and dived ſome part of the way, eſpecially with their heads, yet they were immediately boyed up again. Within an hour or a little more they were all moveleſs, and lay floating on the water; wherefore I opened the Receiver, upon which the Air ruſhed in, and almoſt all of them (which were many) preſently ſunk to the bottom, but none of them recovered to life.

Experiment 2.

A little after theſe, we included a leſſer number of *Tadpoles* in a ſmaller Glaſs, which was alſo exhauſted with the like circumſtances with the former. And when I found the other *Tadpoles* to be dead, I haſted to theſe, which did not, except perhaps one, give any ſign of Life, but upon letting in the Air, theſe having not been long kept from it, ſome few of them did recover, and ſwam up and down lively enough for ſome time; though after a while they alſo dyed.

Experiment 3.

Some years after I repeated the ſame Experiment in a portable Receiver of a convenient kind, and though after the Exhauſtion was perfected, the Tadpoles did for a while move briskly enough on the top of the water (none of them appearing able to dive or ſwim under water) yet coming to look on them at the end of an hour, they ſeemed to be all of them quite dead, yet continued floating. And though within half an hour after that, I let in the Air upon them, yet all the effect of it was, that the moſt of them immediately ſunk to the bottom, as the reſt of them did a very little while after; none of them, that I could obſerve, recovering any vital motion.

Experiment 4.

There remains an Experiment, which I often judged as well more hopefull as more noble, if I could procure an opportunity to bring my deſign to a tryal, which I have found it very difficult to do; nevertheleſs I was able to do it once, though not fully as I deſired, yet not altogether without ſucceſs.

We procured then, and with much adoe, ſome of thoſe odd Inſects, which I elſewhere deſcribe, whereof *Gnats* have by ſome ingenious men been obſerved to be generated about the end of *Auguſt*, or beginning of *September*. Theſe for ſome weeks live all together in the water (as *Tadpoles* do) ſwimming up and down therein, till they are ripe for a transmigration into Flyes: which it ſelf is ſo great a Rarity in Nature, as makes theſe little Creatures recompence to our Curioſity the trouble, they often

ten give our faces and hands. Suppoſing then that, if I could get ſome of theſe, and include them, being of thoſe Inſects they call *Aquatilia*, and ſo minute as they are, they may live a great while in the Receiver without Air, and in the mean while attain the Period, which, according to natures courſe, is wont to turn them into flyes, which might come forth winged Creatures into a Medium not furniſhed with common Air, as others of their kind enjoy; ſuppoſing, I ſay, that theſe Inſects would afford me ſome information about theſe particulars, having upon much watching met with four or five of them after a ſhower of Rain, that dropt from a houſe into a veſſel laid on purpoſe for it, we included them with ſome of their water into a ſmall Glaſs Receiver, which being very exactly cloſed, we kept in a South-window, where theſe little Creatures continued to ſwim up and down for ſome few dayes without ſeeming to be much incommodated by ſo unuſual an habitation; and at the end of that time, and much about the ſame day, they deveſted the habit they had, whileſt they lived as fiſhes, and appeared with their *Exuviæ* or caſt coats under their feet, ſhewing themſelves to be perfect *Gnats*, that ſtood without ſinking upon the ſurface of the water, and diſcovered themſelves to be alive by their motion, when they were excited to it: but I could not perceive them to fly in that thin medium; to which inability, whether the viſcoſity of the water might contribute, I know not; though they lived a pretty while, till hunger or cold deſtroyed them. Some thing in this Experiment may deſerve ſerious Reflections; which I cannot ſpare time to offer at.

A Digreſſive Experiment concerning the Expanſion of Bloud and other Animal Juyces.

For ſome purpoſes, relating partly to Reſpiration, and partly to other Enquiries, I thought fit to endeavour to obtain what information could be procured, of the Conſiſtence and Diſpoſition to expand it ſelf of *Blood* and other Animal Liquors; In purſuance of which the enſuing tryals, among others, were undertaken.

The warm Blood of a Lamb or a Sheep being taken as it was haſtily brought from the Butchers, where the Fibers had been broken to hinder the coagulation, was in a wide mouth'd Glaſs put into a Receiver, made ready for it; and the pump being early ſet on work, the Air was diligently drawn out: but the Operation was not alwaies, eſpecially at firſt, ſo early manifeſt, as the Spirituouſneſs of the Liquor made ſome expect; yet this hindered not but after a long expectation, the more ſubtle parts of the Blood would begin to force their way through the more clammy ones, and ſeem to boyle in large cluſters, ſome as big as great Beans or Nutmeggs; and ſometimes, to the wonder of the by-ſtanding Phyſitians, the Blood was ſo Volatile, and the expanſion ſo vehement, that it boyled over the containing Glaſs; of which, when it was put in, it did not, by our eſtimate, fill above a quarter. Having alſo included ſome *Milk* warm from the Cow in a Cylindrical veſſel of about four or five inches high, though the Operator were induced to pump a great while before any intumeſcence appeared in the milk, yet afterwards, when the external Air was fully withdrawn, the white liquor began to boyle in a way that was not ſo eaſy to deſcribe, as pleaſant to behold: And this it did for a pretty while with ſo much impetuoſity, that it threw up ſeveral parts of it ſelf out of the wide mouthed Glaſs that contained it (and could have contained as much more) though there were not above two or three ounces of the liquor.

A yet greater diſpoſition to intumeſcence we thought we obſerved in the *Gall*, which was but ſuitable to the viſcoſity of the Texture.

Note, that the two foregoing Experiments were made with an Eye caſt upon the inquiry, that I thought might be made; Whether, and how far the deſtructive operation of our Engin upon the included Animal, might be imputed to this, that upon the withdrawing of the Air, beſides the removal of what the Airs preſence contributes to life, the little Bubbles generated upon the abſence of the Air in the Bloud, juyces, and ſoft parts of the Body, may by their Vaſt number, and their conſpiring diſtenſion, variouſly ſtreighten in ſome places, and ſtretch in others, the Veſſels, eſpecially the ſmaller ones, that convey the Bloud and Nouriſhment; and ſo by choaking up ſome paſſages, and vitiating the figure of others, diſturb or hinder the due circulation of the Bloud? Not to mention the pains that ſuch diſtenſions may cauſe in ſome Nerves, and membranous parts, which by irritating ſome of them into Convulſions may haſten the death of Animals, and deſtroy them ſooner by occaſion of that irritation, than they would be deſtroyed by the bare abſence or loſs of what the Air is neceſſary to ſupply them with. And to ſhew, how this production of Bubbles reaches even to very minute parts of the Body, I ſhall add on this occaſion (hoping that I have not prevented my ſelf on any other,) what may ſeem ſomewhat ſtrange, what I once obſerved in a *Viper*, furiouſly tortured in our Exhauſted Receiver, namely that it had manifeſtly a conſpicuous Bubble moving to and fro in the wateriſh humour of one of its Eyes.

Another Digreſſive Experiment belonging to the ſame Title.

To ſhew, that not only the Bloud and Liquors, but alſo the other Soft parts, even in cold Animals, have Aerial particles latitant in them; we took the *Livers* and *Heart* of an *Eele*, as alſo the Head and Body of another fiſh of the ſame kind, cut a ſunder croſſe wayes ſomewhat beneath the heart, and putting them into a Receiver, upon the withdrawing of the Air we perceived, that the Liver did manifeſtly ſwell every way, and that both the upper and lower parts did ſo likewiſe; and at the place where the diviſion had been made, there came out in each portion of the fiſh divers Bubbles, ſeveral of which ſeemed to come from the *Medulla Spinalis*, or the cavity of the Back-bone, or the adjoyning parts; and the External Air being let in, both the portions of the Eele preſently ſhrunk, ſome of the skin ſeeming to be grown empty or flaccid in each of them.

The XIV. Title.

Of the power of Aſſuefaction to enable Animals to hold out in Air, by Rarefaction made unfit for Reſpiration.

The power of Aſſuefaction *in other Caſes, made me think it very well worth trying what it would do in Reſpiration: And the rather, becauſe I preſumed, it might prove an Experiment of good uſe, if we ſhould diſcover, that by a gradual accuſtomance an Animal may be brought to live, either in a* much thinner *Air, or much longer in the* ſame *Air, than at firſt he could. But in regard that to make ſuch a Tryal perſpicuouſly enough, the opacity of the Bladder made uſe of in the former* Title, *was like to be an Impediment, I deviſed another way to obviate that Inconvenience, which may, I hope, be competently underſtood, by the heedfull peruſal of the following Tryals.*

Experiment 1.

We included in a round Violl with a wide neck, (the whole Glaſs being capable of containing about 8 ounces of Water) a young and ſmall *Mouſe*, and then tyed ſtrongly upon the upper part of the Glaſſes neck a fine thin bladder, out of which the Air had been carefully expreſſed, and then conveyed this Phantaſtical Veſſel into a middle ſized Receiver, in which we alſo placed a Mercurial *Gage* (adjuſted by our elſewhere mentioned ſtandard;) This done, the Air was by degrees pumped out, till it appeared by the Gage, that there remained but a fourth part in the *external* Receiver (as for diſtinctions ſake I call it ;) whereupon the Air in the *internal* Receiver expanding it ſelf, appeared to have blown the Bladder almoſt half full, and the Mouſe ſeeming very ill at eaſe by his Leaping, and otherwiſe endeavouring to paſs out at the neck of his uneaſy Priſon; we did, for fear the over thin Air would diſpatch him, let the Air flow into the external Receiver, whereby the bladder being compreſſed, and the Air in the Violl reduced to its former denſity, the little Animal quickly recovered.

Experiment 2.

A while after, without removing the bladder, the Experiment was repeated, and the Air by the help of the Gage was reduced to its former degree of Rarefaction, and the Mouſe, after ſome fruitleſs endeavours to get out of the Glaſs, was kept in that thin Air for full 4 minutes; at the end of which he appeared ſo ſick, that, to prevent his dying immediately, we removed the External, and took out the Internal Receiver. Whereupon, though he recovered, yet 'twas not without much difficulty, being unable to ſtand any longer upon his feet, and for a great while after continued manifeſtly trembling.

Experiment 3.

But having ſuffered him to reſt a reaſonable ſpace of time, preſuming that aſſuefaction had accuſtomed him to greater hardſhips, we conveyed him again into the external Receiver, and having brought the Air to the former degree of Expanſion, we were able to keep him there for a full quarter of an hour; though the external Receiver did not at all conſiderably leak; as appeared both by the Mercurial Gage, and by the continuing diſtenſion of the Bladder. And 'tis worth noting, That, till near the latter end of the quarter of an hour, not only the Animal did ſcarce at all appear diſtreſſed, remaining ſtill very quiet: but, which is more, whereas, when he was put in, the tremblings formerly mentioned were yet upon him and continued ſo for ſome time; yet afterwards, in ſpight of the Expanſion of the Air he was then in, they left him early enough And when the Internal Receiver was taken out, he did not only recover from his fainting fit ſooner then before; but eſcaped thoſe ſubſequent tremblings we have mentioned.

Experiment 4.

Incouraged by this ſucceſs, after we allowed him ſome time to recollect his ſtrength, we reconveyed him and the odd veſſel, wherein he was included, into the former Receiver, and pumped out the Air, till the Mercury in the Gage was not only drawn down as low as formerly; but near half an Inch lower, that there the Air might be yet further expanded, than hitherto it had been. And though this did at firſt ſeem to diſcompoſe our little Beaſt; yet after a while he grew very quiet, and continued ſo for a full quarter of an hour: when, being deſirous to try what operation a further Rarefaction of the Air would have upon him, we cauſed three Exſuctions more to be made by the Pump, before we diſcovered him to be in manifeſt danger, (at which time the Bladder appeared much fuller then before;) but then we were obliged to let the Air into the outward Receiver; whereupon the Mouſe was more ſpeedily revived then one would have ſuſpected.

And theſe tryals of the Power of Aſſuefaction ſeemed the more conſiderable, becauſe the Air, in which the Mouſe had all this while lived, had been clogged and infected with the excrementitious Effluviums of his Body; for 'twas the ſame all along, we having purpoſely forborn to take off the Bladder, whoſe regular Intumeſcencies and ſhrinkings ſufficiently manifeſted, that the veſſel, whereof 'twas a part, did not leak

POSTSCRIPT.

Though the ſucceſs of the recited Experiments is very promiſing; yet a ſubſequent Tryal or two, whoſe particularities are ſlipt out of my memory, oblige me, in point of Candour, to declare, that, for further ſatisfaction, the Tryals of the power of Accuſtomance in reference to Air unfit for Reſpiration, ought to be both reiterated, and to be made in differing ſorts of Animals.

The XV. Title.

Some Experiments ſhewing, that Air, become unfit for Reſpiration, may retain its wonted preſſure.

Experiment 1.

We took a Mouſe of an ordinary ſize and having (not without ſome difficulty) conveyed him into an Ovall Glaſs, fitted with a ſomewhat long and conſiderably broad neck, which we had provided, that it might be wide enough to admit a Mouſe in ſpight of his ſtruggling. We conveyed in after him a Mercurial Gage, in which we had diligently obſerved and marked the Station of the Mercury, and which was ſo faſtned to a Wire reaching to the bottom of the Oval Glaſs, that the Gage, remaining in the neck, was not in danger to be broken by the motions of the Mouſe in the Oval part: The upper part of the long neck of the Glaſs was, notwithſtanding the wideneſs of it, hermetically ſealed by the help of a Lamp and a pair of Bellows, that we might be ſure, that the imprisoned Animal,ſhould breath no other Air, then that which filled the Receiver at the time when it was nipped up.This done,the Mouſe was watched from time to time,and though by reaſon of the largeneſs of the Veſſel in compariſon of ſo ſmall an Animal,he ſeemed to me rather drooping then very near death at the end of the ſecond hour ; yet coming to look upon him about half an hour after,he was judged by the Spectators quite dead,notwithſtanding our ſhaking of the Veſſel to rouze him up. This made me caſt my eyes upon the Gage,wherein I could not perceive any ſenſible change of the Mercuries Station.But being unwilling to give over the Mouſe without trying what freſh Air would do to recover him, I cauſed the ſealed part of the Glaſs to be broken off, and,notwithſtanding that his continuing to appear dead increaſed the confidence of thoſe that thought him ſo,I obtained after a while ſome faint tokens of life ; though I am not ſure,that they would have continued in a Veſſel where the Air was ſo clogged and infected,if it had not been that freſh Air was frequently blown in by a pair of Bellows,whoſe noſe was inſerred into the neck of the Glaſs.This freſh Air ſeemed evidently,though but ſlowly,to revive the gaſping Animal,whom I would not,nor could not conveniently take out of the Glaſs, till he had gained ſtrength enough to make uſe of his Leggs ; after which without breaking of the Glaſs (which I was loath to looſe,having then no other of the kind) we took him out and found him quickly able to go up and down. After which ſervice,and another Tryal we had made with him,which belongs not to this place,we ſet him at liberty to ſhift for himſelf.

Experiment 2.

Such an Experiment as the former we made with like ſucceſs upon a ſmall Bird included *with a Gage* in a Receiver holding about a quart of Water. The Bird in about half an hour appeared to be ſick and drooping, and the faintneſs and difficulty of breathing increaſed for about two hours and an half after that,at which time the Animal dyed,the Gage being not ſenſibly altered unleſs perhaps the Mercury appeared to be impelled up a little thought higher than it was when put in ; which yet might well enough proceed from ſome accidental cauſe.

Experiment 3.

To ſatisfie ſome curious perſons ; that it is not *want* of *Coldneſs*, but ſomething elſe in the included Air,that makes it deſtroy the Birds that are pent up in it,and by the hot Exhalations that ſteam from their bodies may be ſuppoſed to overwarm it,we made the following Experiment.

In a Glaſs-Viol,capacious enough to hold about 3 quarts of water , we not only included,but for greater accuracy hermetically ſealed up a ſmall Bird, and found, that in a few minutes he began to be ſick and pant ; which Symptoms I ſuffered to continue and encreaſe againſt the mind of a learned byſtander,(who thought the Animal would not hold out ſo long,) till they had laſted juſt half an hour : at which time having provided a veſſel of water with *Sal Armoniack* newly put into it,to refrigerat it ,(according to the way I elſewhere publiſhed ;) and the liquor thus made exceeding cold, ſomewhat to the wonder of thoſe that felt it ; the Viol with the ſick Bird was immerſed in it and kept there in that condition for 6 minutes ; and yet it did not appear, in the judgment of the By-ſtanders, that the great refrigeration; that muſt be this way procured to the impriſoned Air, did ſenſibly revive or refreſh the drooping Animal, who manifeſtly continued to pant exceedingly as before, and, as ſome affirmed, more; So that this remedy proving ineffectual, the viol was removed out of the water, and the Bird ſometime after did, as I foretold, make many ſtrains to Vomit (though ſhe brought up little) followed by Evacuations downward, before ſhe quite expired, which ſhe did within a minute or two of a juſt hour, after the beginning of her impriſonment.

If I had been able (which I was not) to procure more Birds, I would willingly have proſecuted this Experiment by ſeveral other not unhopefull tryals; which for want of Subjects I was fain to leave only deſigned.

The XVI. Title.

Of the uſe of the Air to elevate the Steams of Bodies.

In the Digreſſion about Reſpiration annext to the 41th of our *Phyſico-mechanical* Experiments formerly publiſhed, it is propoſed as one of the conſiderable uſes of the Air in Reſpiration, that, being drawn into the Lungs, it ſerves to carry off with it, when 'tis breathed out again, the Recrementitious ſteams that are ſeparated from the maſs of Blood in its Paſſage through the Lungs: from which fuliginous Excrements if the Blood were not continually freed by the help of the Air, after nature had been accuſtomed to that way of diſcharging them, their ſtay in the body might have very great and deſtructive Operations on it.

For the Illuſtration of this uſe of the Air, I ſhall now ſubjoyne the following Experiment.

We made by diſtillation a blood-red Liquor, which chiefly conſiſted of ſuch Saline and Spirituous particles, as may be obtained from the Maſs of Blood in humane Bodies; This Liquor is of ſuch a Nature, that if a Glaſs Viol, about half filled with it, be kept well ſtop'd, the red liquor will reſt as quietly as any ordinary one, without ſending up any ſmoak or viſible Exhalation; But if the Viol be unſtopped ſo, that the external Air be permitted to come in, and touch the Surface of the Liquor, within a quarter of a minute or leſs, there will, upon this Contact, be elevated a copious white ſmoak, which will not only fill the upper part of the Glaſs, but plentifully paſs out into the open Air, till the Viol be again ſtopped.

My purpoſe in this Tract to forbeare ſidings in Controverſies, keeps me from taking notice of the ſpeculations ſuggeſted by ſome of the Phœnomena of this Liquor; which yet I thought I might lawfully mention, as far as I have done it, becauſe it but adventures upon giving one of the Uſes rather of the Air, then immediately of Reſpiration it ſelf; and is brought but to illuſtrate what I have not found denied by any, though conſidered by very few; namely, the office of the Air to carry off in Expiration the fuliginous ſteams of the Lungs. For, in our Experiment we manifeſtly ſee, that the very Contact of the Air may give the Corpuſcles of moiſt bodies a peculiar Volatility, or facility to emerge in the form of Steams, I know, there are ſome Corroſive Spirits, as in Nitre and Salt, ſimple, or compounded of them, that, when they are very ſtrong, emit for a while manifeſt fumes; but the difference of thoſe Liquors, and their inferiority to our red Spirit, in the Capacity of ſmoaking Liquors, might eaſily enough be manifeſted, if it were judged proper in this place, where it may ſuffice, to take notice of theſe two things: The *one* is, That when the Viol has lain ſtopped and quiet a competent time, the upper half of it will appear deſtitute of fumes, of which the Air, it ſeems, will imbibe, and conſtantly retain *but* a certain moderate quantity, which may give ſome light towards the Reaſon, Why the ſame Air, which will be quite clogged with ſteams, will not long ſerve for Reſpiration, which requires frequent ſupplies of freſh Air: The *other* is, That if the unſtop'd Viol were placed in our *Vacuum*, it would not emit any viſible ſteams at all, nor ſo much as to appear in the upper part of the Glaſs it ſelf that held the Liquor; whereas, when the Air was by degrees reſtored at the ſtopcock, without moving the Receiver it ſelf, to avoid injuring its cloſeneſs, the returning Air would preſently raiſe the fumes, firſt into the vacant part of the Viol, whence they would aſcend into the Capacity of the Receiver; and likewiſe, when the Air, that was requiſite to ſupport them, was pumped out, they alſo accompanied it, as their unpleaſant ſmell evinced, and the red Spirit, though it remained unſtopped, emitted no more fumes till the new Air was let in.

One may compare with this Liquor another Smoaking one, mentioned in the 29th of the firſt publiſhed Pneumatical Experiments, where an Experiment is related of it, that has ſomething in common with *this*, and may ſo far ſerve to confirm what is now delivered, as this alſo has ſome things additional to *that*: Beſides that that Liquor being made with Ingredients Corroſive, and of a bad name among Chymiſts themſelves, the fumes, that proceed from it, may fright many from daring to meddle with it: whereas this our red Spirit has been found potently medicinal for ſome diſtempers of the Lungs by a Dr. *of Phyſick*, whom I deſired to try it. The other Phœnomena of this Liquor I ſhall not ſtay to deſcribe as not belonging to this place, and the Liquor it ſelf with very little variation I have in the *Hiſtory of Colours* communicated.

The XVII. Title.

Of the long continuance of a Slow-worm *and a* Leech *alive in the Vacuum made by our Engin.*

In the often cited digreſſion about Reſpiration, there is mention made of the great Vivaciouſneſs of *Houſe-Snails* as they call them, and how little operation the withdrawing of the Air had upon them in compariſon of what 'tis wont to have on other Animals. I ſhall now add by way of Confirmation, that I made Tryal upon ordinary *white Snails without ſhells*, whereof two of differing ſizes (the biggeſt about an Inch and a half, and the other about an Inch in length) were included in a ſmall portable Receiver, which being carefully exhauſted, and ſecured againſt the Return of the Air, was attentively conſidered by me, preſently after 'twas removed from the Engine; whereby it was eaſy to diſcern, that both the Snails thruſt out and retracted their Horns (as they are commonly called) at pleaſure, though their Bodies had in the ſofter places pretty ſtore of newly generated Bubbles ſticking to them: but though they did not looſe their motion near ſo ſoon, as other Animals were in our *Vacuum* wont to do; yet coming to look on them after ſome hours, they appeared moveleſs and very tumid, and at the end of 12 hours the inward parts of their bodies ſeemed to be almoſt vaniſhed, and they ſeemed to be but a couple of ſmall full-blown Bladders; and on the letting in of the Air they immediately ſo ſhrunk, as if the Bladders having been prick'd, the receding Air had left behind it nothing but skins; nor did either of the Snails afterwards, though kept many hours, give any ſigns of life.

Upon a ſuppoſition that the cold, and clammy Conſtitution of Snails might be a main cauſe of their being able to endure the abſence of the Air ſo well, I thought it worth Tryal, whether *Efts* and *Leeches* might not yet be more able to continue in our Vacuum then a Snail; and accordingly ſome Experiments were made perſuant to that Curioſity; the moſt fully regiſtred whereof are theſe that follow.

Experiment 1.

We included in a Receiver, whoſe Globular part was about the bigneſs of a large Orange, one of that ſort of Animals, that they vulgarly call *Efts*: having withdrawn, but not ſollicitouſly, the Air, and ſecured the veſſel againſt the unpermitted return of it, we kept him there about 48 hours, during all which time he continued alive, but appeared ſomewhat ſwelled in his belly; his under-chap moving the very firſt night, but not the day and night following. By opening the Receiver at length under water, we perceived, that about half the Air had been drawn out. As ſoon as the water was impelled into the Glaſs, the Animal, that was before dull and torpid, ſeemed, by very nimble and extravagant motions, to be ſtrangely revived.

Experiment 2.

We took a *Leech*, that was of a moderate bigneſs, or ſomewhat ſhort of it, and having included it together with ſome water in a portable Receiver, that was gueſſed to be capable of holding about 10 or 12 ounces of that liquor; the Air was pumped out after the uſual manner, and the Receiver being removed to a lightſome place, we obſerved, as we expected, that, the Leech keeping her ſelf under water, there emerged from divers parts of her Body ſtore of Bubbles, ſome of them in a diſperſed way, but others in Rows or Files, if I may ſo ſpeak, that ſeemed to come from determinate points. Though this Production of Bubbles laſted a pretty while, yet the Leech did not ſeem to be very much diſcompoſed by her preſent condition This done we diſpoſed of the Receiver, which was well ſecured from the ingreſs of the outward Air, into a quiet place, where we daily viſited it once at leaſt, or oftner, as there was occaſion;

and found the Leech ſomewhat faſtened by her tail to that part of the Glaſs that was under water, and ſometimes wandring about that part, which was quite above water ; and ſtill,when we endeavoured to excite her,ſhe quickly manifeſted her ſelf to be alive : And indeed (which will be thought ſtrange) appeared ſo lively after the full expiration of five natural days,that expecting ſomething might have happened to the Receiver,and thereupon reſolving to try how ſtanch it had continued, I opened it under water,by which means the outward Air impelled in ſo much of that Liquor,that I was ſatisfied, the Receiver was immediately before as well exhauſted,as others are wont to be in our Pneumatical Experiments.

The XVIII. Title.

Of what happened to ſome Creeping *Inſects in our* Vacuum.

Notwithſtanding the great Variety of Reptills, that Nature does almoſt every where produce ; yet the inconvenient time and place,wherein the following Tryals were made,ſupplyed me with ſo few, that about theſe Animals I find among my Adverſaria no more then the enſuing Notes.

Experiment 1.

We took five or ſix *Caterpillars* of the ſame ſort ; but I could not tell to what ultimate ſpecies the Writers about Inſects referred them. Theſe being put into a ſeparable Receiver of a moderate ſize, had the Air drawn away from them,and carefully kept from returning.But notwithſtanding this deprivation of Air,I found them,about an hour after, moving to and fro in the Receiver ; and even above two hours after that, I could by ſhaking the Veſſel, excite in them ſome motions, that I did not ſuſpect to be Convulſive. But looking upon them again ſome time before I was to go to bed (which may be was about 10 hours after they were firſt included) they ſeemed to be quite dead, and, though the Air were forthwith reſtored to them, they continued to appear ſo, till I went to Bed ; yet,for Reaſons elſewhere expreſſed,I thought fit to try, whether time might not at length recover them, and leaving them all night in the Receiver,I found the next day,that 3,if not 4 of them,were perfectly alive.

Experiment 2.

We took from an hedge a branch, that had a large Cobwebb of Caterpillars in it,and having divided it into two parts, we put them into like Receivers, and in one of them ſhut up the Caterpillars together with the Air,which from the other was exhauſted. The event was, That in that which had the Air,the little and difficultly viſible Inſects,after a ſmall time,appeared to move up and down as before, and ſo continued to do for a day or two ; after which, other occaſions made the Experiment to be neglected : whereas that Glaſs whence the Air had been drawn out,and continued kept out, ſhewed after a very little while no motion that we could perceive. But to try, Whether Caterpillars may continue ſo far alive in our *Vacuum* all the winter, as the next Spring or Summer to proceed in the tranſmigration to a Butterfly, is a Tryal that we have but begun, and therefore muſt not pretend to ſay any thing about its Event.

The XIX. Title.

Of the Phænomena ſuggeſted by Winged Inſects *in our Vacuum.*

When our Phyſico-mechanical Experiments were diſpatched to the Preſs, the inconvenient ſeaſon of the year, and the difficulty of making the Receivers, I then employed, to keep out the Air for any long time, hindered me from then publiſhing above a Tryal or two of what would happen to *Winged Inſects* in our Vacuum. But afterwards being provided of more commodious Veſſells, I thought fit at ſeveral times to repair that Omiſſion by various Attempts, where of the chief enſue.

Experiment 1.

There were taken 4 middle-ſiz'd *Fleſh-flies*, which having their heads cut off were incloſed in a Portable Receiver, furniſhed
Novemb. 12th with a pretty large Pipe and a Bubble at the end. As ſoon
about 8 *a Clock* as the Receiver was Exhauſted, thoſe Flies loſt their mo-
at night. tion (which was not brisk before;) an hour or two after, I approached them to the fire, which reſtored not their Motion to them (but as to one of them I ſuſpected it had a Languid motion for a while ;) wherefore I let in the Air upon them, after which in a very ſhort time (though not immediately) they began one after another to move their Leggs, and one or two of them to walk ; and having kept them all night in a warm place, when I ſent one the next morning to try, if they would manifeſt any motion, he told me, that for a while they did, though, when I afterward riſe my ſelf, I could not perceive any motion in them.

Experiment 2.

About Noon we cloſed up divers *ordinary Flies*, and a *Bee* or *Waſp* ; all which, when the Air was fully withdrawn, lay as dead, ſave
Sept. 11th. that for a very few minutes ſome of them had Convulſive motions in their Leggs. They continued in this ſtate 48 hours, after which the Air was let in upon them, and *that* not producing any ſigns of Life in them, they were laid in the Meridian Sun, but not any of them ſeem'd in any degree to recover.

Experiment 3.

We put a great *Fleſh-fly* into a very ſmall portable Receiver, where at firſt it appeared to be very brisk and lively, but as ſoon
Dec.the 11th. as the Air was drawn out, fell on his back and ſeemed to have Convulſive motions in her feet and *Proboſcis* ; from whence ſhe preſently recover'd upon the letting in of the Air ; which being drawn out again, ſhe lay as dead : but a while after, (within a quarter, or half an hour) I perceived, that upon ſhaking the Receiver, ſhe ſtirred up and down, (but faintly.) This was done pretty late yeſter-night, ſince whence I had not occaſion to look on the Glaſs, till this night after Supper, when I found the fly not (whileſt I ſtayed to endea-

vour it) to be recovered either by warmth, or letting in the Air. A while after this Note was written, this Fly recovered; and being next morning ſealed up again in that Glaſs, and kept 48 hours, though over the Chimney, died for good and all.

Experiment 4.

We took a large *Graſs-hopper*, whoſe Body, beſides the Horns and Limbs, was about an Inch in length, and of a great thickneſs in Proportion to that length: this we conveyed into a Portable Receiver of an Oval form, and capable of holding (by our gueſs) about a Pint of water and more, and having afterwards pumped out the Air, till by the Gage it appeared to have been pretty well drawn out, we took care, no Air ſhould reenter to diſturb the Experiment. The ſucceſs whereof was this: Firſt, Though, before the Exhauſtion of the Air was begun, the Graſhopper was ſtirring, and lively, and continued ſo for a while after the beginning of the Operation; yet when the Air began to be conſiderably rarified, he appeared to be very ill at eaſe, and ſeemed to ſweat out of the Abdomen many little drops of Liquor, which being united trickled down the Glaſs like a little ſtream, which made at the Bottom a ſmall Pool of clear Liquor, amounting to near a quarter of a Spoonful, and by that time the Receiver was ready to be taken off, the Graſhopper was fallen upon his back, and lay as dead. Secondly, Though having a little after laid the Glaſs in a South window, on which the Sun then ſhone, I perceived ſome ſlow motions in the Thorax, as if he ſtrained to fetch breath; yet I was not ſure they were not Convulſive motions, and what ever they were, they laſted but a while, and then the Animal appeared to be quite dead, and to continue ſo for three hours from the removal of the Receiver. Thirdly, that time being expired, the Glaſs was opened and the Air let in upon him, notwithſtanding which there appeared no ſign at all of Life; but imagining there might be ſome time requiſite to recover him out of ſo deep a ſwoon, I let the Glaſs reſt in a convenient Poſture, that the water that came from him might not endanger him, for a quarter or half an hour, and though I then perceived no ſigns of Life, yet being deſirous to perſue the Tryal yet further, I cauſed him to be carried into a Sunſhiny place, where the Beams of a declining Sun preſently began to make him ſtir his Limbs, and in a ſhort time brought him perfectly to Life again.

Experiment 5.

We took one of thoſe *ſhining Beetles* they call *Roſe-Flies*, and having included it in a very ſmall round Receiver, which we exhauſted, and though he that attended the Engine, affirmed, it ſtrugled much whileſt the Air was withdrawing, yet preſently after, I could perceive but little motion (and part of that ſeemed almoſt Convulſive) and afterward going abroad, and not returning to look on the Glaſs till about 6 hours after, the Fly ſeemed quite dead, and diſcovered not any motion upon that of the Glaſs. And within about an hour after, though I let the Air ruſh in; yet no ſign of Life

April the 15th.

enſued

enſued, neither immediately, nor for a pretty while after. So that ſuſpecting the fly to be really dead, and yet not reſolutely concluding it, though I would then wait no longer, yet three or four hours after (*viz.* about 10 of the Clock at night) I returned to the Receiver, and found the *Beetle* lively enough. Whereupon I cauſed the Glaſs to be again exhauſted, and ſecured from the Ingreſs of the Air, during which time the Animal ſeemed to be much diſquieted by what was done to it, but did not looſe its motion before I went to bed, which was ſoon after.

Experiment 6.

About *Butterflies* I remember I made ſeveral Tryals, moſt of which chanced to be loſt; but thus much I very well remember, that having obſerved them not only to live but to move longer then was expected, I choſe to include divers of them in Receivers ſomewhat large, eſpecially that I might ſee, whether in ſo thin a Medium ſome or other of them, by the help of their large wings, would be able to fly. But though, whileſt the Air continued in the Glaſſes, they flew actively as well as freely up and down; and though after the Exhauſtion of the Air, they continued to live and were not moveleſs; nay though at the bottom of the Receiver they would even move their wings and a little flutter, yet I could not perceive any of them to fly, by which I mean, perform any progreſſive motion ſupported by the Medium only. And by frequently inverting the Receiver (which I took care ſhould be pretty long to let them fall from one extream to the other,) they would fall like dead Animals without diſplaying their wings, though juſt as they came to touch the Bottom, ſome of them would ſometimes ſeem to make ſome uſe of them, but not enough to ſuſtain themſelves, or to keep their falls from being rude enough.

The XX. Title.

Of the neceſſity of Air to the motion of ſuch ſmall Creatures, as Ants *and even* Mites *themſelves.*

In the Experiments hitherto mentioned, the Animals, on which the Tryals have been made, were divers of them of a moderate Bulk; and others of them, though ſmall, yet not of the leaſt ſizes that Nature afforded us. Wherefore I thought fit to annex the following Experiments, wherein I deſigned to examine, Whether even thoſe minute ſorts of Animals, whoſe bulk is thought the moſt contemptible, have not, as well as the greater, need of the Air, if not to make them live; yet at leaſt to enable them to move.

A pretty number of *Ants* were included in a ſmall Portable Receiver exhauſted yeſterday about noon: Between 6 and 7 in the Afternoon they ſeemed to be all quite dead, and the rather, becauſe, though they were very lively juſt before they were ſealed up, running briskly up and down the Bubble they were in; yet they grew almoſt moveleſs as ſoon as the Air was exhauſted; and a little while after appeared more ſo: though I then ſuſpected more then I ſince did, that they were much inconvenienced by ſome ſmall glutinous ſubſtance that ſeemed to have got into the ſmall Receiver from the Vapours of the Cement. When I looked on them at the the time lately mentioned, I opened the Glaſs, whereupon the Air ruſhed in; but no ſign of Life appeared for a great while in any of the *Ants:* but looking upon them this morning about 9 a Clock, I found many of them alive and moving to and fro.

It is ſaid by Naturaliſts upon the Authority of Ariſtotle,*that the Animal, the* Greeks *call ἄκαρι, is the minuteſt of Living Creatures. But thoſe of this ſort being very hard, if at all, to be met with here, I thought fit to make ſome Experiments upon the leaſt of the Terreſtrial Animals I could procure, and try, whether or no* Mites *themſelves, which are reputed but* Living Points, *and not to be taken notice of by the naked Eye to be living, but by motions which even an attentive one can ſcarce diſcover, ſtand in need of the Air; eſpecially becauſe, in caſe they do, it may ſuggeſt to us ſome odd Reflections upon the ſtrange ſubtlety and minuteneſs of the Aerial particles, which muſt be capable of flowing in and paſſing out at the inviſible and almoſt in-imaginable ſmall pores and other cavities of the parts of an Animal, whoſe entire body is reputed but a* Phyſical *point.*

We conveyed then a pretty number of *Mites*, together with the mouldy Cheeſe, they were bred in to nouriſh them, into 3 or 4 Portable Receivers (which were all of them very ſmall,) not much differing in ſize. From all of theſe, ſave one, we withdrew the Air; and then, making uſe of our peculiar contrivance to hinder its return, we took them one after another from the Engin, and laid them by, for further obſervation. That *one*, which I took notice that we had reſerved, and in which, to obſerve the difference, we thought fit to leave the Air, was ſealed at a Lamp-furnace after the uſual manner of nipping up Glaſſes there. This done, there remained nothing but to obſerve the Event of our Tryals, which afforded us the enſuing *Phœnomena*;

1. Thoſe Mites, that were incloſed in the ſmall Glaſs that never came near the Engin, continued alive and able to walk up and down for above a full week, after they had been put in, and poſſibly would have continued much longer, if the Glaſs had not been accidentally broken,

2. As ſoon as ever one of the Receivers was removed from the Engin, I looked with great attention upon it; and though juſt before the withdrawing of the Air the *Mites* were ſeen to move up and down in it; yet within a few minutes after the Receiver was applyed to the Engin, I could diſcern in them no Life at all, nor was any perceived by ſome younger Eyes then mine, whereunto I expoſed them. Nay by the help of a double Convex-glaſs (that was ſo ſet in a frame as to ſerve me as a Microſcope on ſuch occaſions) I was not able to ſee any of them ſtir up and down. Nor was any motion taken notice of in the other ſmall Receiver of like bigneſs and ſhape with mine, by them that had exhauſted it of Air. And my occaſions not permitting me to attend the obſervation any longer in the place where 'twas made, I took the Receiver, I had ſo attentively conſider'd my ſelf, along with me in the Coach, and having occaſion to make ſome ſtay about an hour after, I looked upon it attentively again, but could not perceive any of the *Mites* to ſtirr; and the like unſucceſsfull obſervation I made when I had a conveniency 2

or 3 hours after that. And the place I did it in being one, where I thought my ſelf as it were at home, I firſt let in the Air, to try if the Mites were not quite dead, and though neither upon its ruſhing in, nor during my ſtay there, I could perceive any of them to ſtir; yet I left the Receiver unſtopt as it was in the Window, upon a ſuſpition that the Air might not be able to produce its operation upon them in a ſhort time.

3. And therefore paſſing by the ſame place about 2 or 3 dayes after, I called in to look upon my Receiver, and found a number of my little Animals revived, as an attentive Eye might eaſily perceive by the motion of certain little white ſpects, when it was helped to obſerve it by little marks, I made on the outſide of the Glaſs (which was purpoſely choſen thinn and clear) near this or that Mite, with a Diamond; by the approach to, or Receſs from which Marks, the progreſſive motion became (perhaps within a minute) plainly diſcoverable, eſpecially if we uſed the following Expedient, (which I found the beſt of thoſe I try'd,) namely, That, when the Eye perceived little white ſpecks that looked like Mites, the Receiver ſhould be ſo turned and returned, that the bellies and feet of thoſe little Creatures were uppermoſt, notwithſtanding which they would not eaſily drop down, but continue their motion; which ſpecks being made upon the Concave ſurface of the thin Glaſs it ſelf (to which you may approach your Eye as much as you pleaſe) are thereby rendred much more eaſily viſible. But, this being only intimated upon the By, I proceed to take notice, that in the newly mentioned Receiver the Mites did, by ſtirring up and down, continue to appear alive for 2 or 3 dayes after, if not longer. I ſhould not, I confeſs, have thought it ridiculous to ſuſpect, that the Mites, which at firſt loſt their motion, did at laſt really dye, and that thoſe, I after ſaw ſtirring up and down, were others newly generated in the included mouldy Cheeſe: But I was not apt to think this ſuſpicion probable; not only becauſe of the extream difficulty of making any living Creature to be generated in *Vacuo Boyliano*, but becauſe it did not ſeem agreeable to what I elſewhere noted about the way and time of the Propagation of Mites, whoſe Eggs I have divers times obſerved with pleaſure, that at a ſeaſon of the year, that was not favourable (for theſe things happened in a cold *March*,) newly generated Mites ſhould in 2 or 3 dayes grow up to their juſt bigneſs, which ſeveral of thoſe, we obſerved, ſeemed to have attained.

4. But becauſe it doth not by the third *Phænomenon* appear, Whether or no, in caſe our Mites had been kept in a moveleſs ſtate for a much conſiderabler time then 3 or 4 hours, they would have been recoverable by the admiſſion of the Air; I ſhall add, to ſatisfy that doubt, That one of the Portable Receivers above-mentioned, being exhauſted and carefully ſecured from the regreſs of the Air, was kept from Munday morning to Thurſday morning: after all which time, our attentive Eyes being unable to diſcover any ſigns of Life among the included Mites, the Air was let in upon them, and, after no long time, had ſuch an operation upon them, that both I and others could plainly ſee them creep up and down in the Glaſſes again.

An

An Accompt of Two Books.

I. *TRACTS written by the Honourable* ROBERT BOYLE, *about the* COSMICAL *Qualities of things; the Temperature of the* SVB-TERRANEAL *and* SVB-MARINE *Regions; and the* BOTTOM *of the Sea; together with an Introduction to the* HISTORY *of* PARTICVLAR *Qualities.* Oxford, 1670. *in* 8°.

THe main Deſign of the Noble Author in theſe as well as his other Phyſical writings, is, to provide ſtill more and more Materials for the Hiſtory of Nature. He prefixes to theſe Tracts an Introduction to the *Hiſtory of particular Qualities*, after he hath already given us an Excellent Account both of the Nature, and of the Origine of Qualities in *general.* And intending now, to proceed to Qualities in *particular*, and to conſider, How far the manner whereby they are produced, and thoſe other Phœnomena of them, that may upon occaſion be taken notice of, will accord with, and, by doing ſo, confirm the Doctrine hitherto propoſed by him; and whether they will not (at leaſt) much better comport with *That*, than the Opinions either of the *Peripateticks*, or the *Chymiſts*.

But before he deſcends to mention any of theſe Particular Qualities, he thinks it worth while to conſider ſome Scruples about the *Corpuſcularian* Doctrine touching Qualities, which unleſs they be removed, may not a little prejudice the reception of a good part of what he purpoſes to deliver about particular Qualities.

Of theſe difficulties he inſiſts chiefly upon that Grand one, which imports, that 'tis incredible, that ſo great a Variety of Qualities, as we actually find to be in Natural Bodies, ſhould ſpring from Principles ſo few in number as two, and ſo ſimple, as *Matter* and *Local Motion*: And here he endeavours to ſhow, not only, that the other Catholick Affections of Matter are manifeſtly deducible from *Local Motion*; but alſo, that theſe Principles, being variouſly aſſociated, are ſo fruitfull, that a Vaſt number of Qualities, and other *Phœnomena* of Nature may reſult from them.

In the Tract of the *Syſtematical* or *Coſmical Qualities*, he maketh it out, That in eſtimating the Qualities of Natural Bodies, we are not only to conſider the power, any particular one hath of acting upon, or the capacity it hath of ſuffering from ſuch and ſuch particular Bodies; but alſo that there may be ſome Attributes, which may belong to this or that Body, and divers alterations, to which it may be lyable upon the account of a Syſteme ſo conſtituted as our World is; whoſe Fabrick is ſuch, that there may be divers unheeded Agents, which, by unperceived means, may have great operations upon the Body we conſider, and work ſuch changes in it, and enable it to work ſuch changes on other Bodies, as are rather to be aſcribed to ſome un-obſerved Agents, than to thoſe other Bodies, with which the Body propoſed is taken notice to have to do.

To this is ſubjoyned an *Appendix* touching *Coſmical Suſpicions*. For, the Author conſidering, that the World is a Subject ſo vaſt, that not only all demonſtrable Truths, which may be diſcovered concerning it, may be look't upon as important, but even *Conjectures* and *Suppoſitions* themſelves that relate to it in general, may deſerve not to be altogether paſſed by in ſilence; He adventureth to entertain the Reader with ſome Thoughts of this nature, thereby taking an opportunity to alledge in their favour ſome Hiſtorical Obſervations, which, whatever the Conjectures be thought of, may appear to be more new than deſpicable.

In the Three remaining Tracts, the Author

Firſt, treats of the *Temperature* of *Subterraneal Regions* and of the Air reaching thither; compriſing the ſum of what he hath to propound, in four Propoſitions; *viz.* That the firſt Region of the Earth is very variable both as to Bounds, and as to Temperature: That the ſecond Region ſeems to be for the moſt part cold in compariſon of the other two: That in ſeveral places, which, by reaſon of their diſtance from the Surface of the Earth one would refer to the Middle Region of it, the Temperature of the Air is very differing at the ſame times of the Year: That the third Region of the Earth hath been obſerved to be conſtantly and ſenſibly warm, but not uniformly ſo; being in ſome places conſiderably hot.

Secondly, of the *Temperature* of the *Submarine Regions* as to Heat and Cold: Where, aſſigning to the *Sea* no more than two Regions; the *one,* from the ſuperficies ſo far downwards as the manifeſt operation of the Beams of the Sun, or other Cauſes of warmth do penetrate; the *other,* from thence to the bottom of the Sea: He obſerveth, that, according to that diviſion the Limits of the upper Region will not be alwaies conſtant in all Climats, in all Seaſons, and in all Weathers. And as to the Temperature of the Lower Region, he taketh notice, that that is generally Cold, ſome few places excepted: Confirming all by conſiderable relations, he procured from Sober and Creditable Navigators, and other Perſons, practiſed in Diving, both with and without Engins.

Thirdly, Of the *Bottom of the Sea*; concerning which he hath enquired *firſt,* after the Inequality of the Soil there, obſerved to be very gradual and abrupt: *Next,* after the great preſſure of the water there againſt other Bodies: *Laſtly,* after the Tranquillity of the water there, whether it be conſiderably diſtant from the Surface.

II. *CATALOGVS PLANTARVM ANGLIÆ & INSVLARVM adjacentium: tum Indigenas, tum in agris paſſim cultas complectens. Operâ* Johannis Raji *M. A. & Soc. Regiæ Sodalis.* Londini, *Impenſis* J. Martyn. 1670. *in* 12°.

The Ingenious and Induſtrious Author of this Book, having ſome years ago publiſht a Catalogue of the Plants growing about *Cambridge*, hath now obliged his Country, by preſenting it with a Catalogue of the Plants of all *England*, and of the Iſles adjacent. In the doing of which, he hath ſpared neither pains nor coſt, travelling himſelf through all the conſiderable parts of this Kingdom, and ſo viewing and gathering himſelf almoſt all the Plants here deſcribed, ſome few excepted, which he ſaith he hath either taken out of the beſt Authors, or received from very creditable and skilfull Friends. Neither hath he been contented to ſearch and gather them himſelf, but alſo diligently compared them with their Hiſtories and Figures found by *Botaniſts*; deſcribing thoſe, which ſeemed to have been omitted by others, and adding, with their Characterical notes, thoſe that had been confuſedly and careleſsly delivered before. A work exceeding uſeful, eſpecially in order to the compoſing a General Hiſtory of Plants, wherein they are to be diſtributed into their ſeveral Families, according to their ſpecifical Differences, (a thing ſo neceſſary to learn them more eaſily, to underſtand them more clearly, and to remember them more laſtingly,) which Diſtribution cannot be made without an accurate and a compleat *Enumeration* and *Deſcription* of the ſeveral Kinds of Plants, growing up and down in the ſeveral parts of the World.

The Reader will find in this *Catalogue*, beſides the moſt neceſſary *Synonyma* of the Plants here enumerated, a ſummary Deſcription alſo of their principal Vertues; enterlaced with the mention of many new Obſervations and Experiments, Medical and Phyſiological. And that, which exceedingly raiſeth the value and endeareth the welcome of this Book, is, That the Author in the *Preface* thereof very obligingly promiſeth a *General Method of all Plants*, together with the differing Characters of their kinds and families, to be publiſhed by him in a ſhort time, and withall (to him poſſible) accurateneſs

London, Printed for *John Martyn*, Printer to the *Royal Society*, at the *Bell*
in St. *Pauls Church-yard*, 1670.

Numb.64.

PHILOSOPHICAL TRANSACTIONS.

October 10. 1670.

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An Extract of a Letter, written by Monſieur Hevelius *to the Publiſher, from* Dantzick, *July* 5. 1670. *Containing chiefly a late Obſervation of the Variation of the* Magnetick Needle; *together with an Account of ſome other Curioſities in thoſe Parts:* Engliſhed, *as follows;*

WOuld to God, that thoſe Excellent Books that are publiſh't in *Engliſh*, were, for the benefit of the whole Learned World, made Latin; All Learned men would be exceedingly obliged to you for it. I am perſwaded, Sir, you will do your part in taking care, that ſo uſeful and ſo neceſſary a work may not be left undone.

Lately, on the *22th.* of *June* (ſt. n.) about the time of the Solſtice, I was ſearching after the preſent *Declination* of the *Magnet*, which 28 years ago (vid.A. 1642.) I had likewiſe obſerved here with great care; as about the ſame time at *Konigsberg* Monſieur *Linnemannus*, the then Profeſſor of the Mathematicks there, had obſerved alſo. We both found the Magnetick Needle at that time to decline from the *North* 3 *d* 5′. *Weſt-ward.* But now it is far otherwiſe; for it declines at preſent, as I have very carefully obſerved, 7 *d.* 20′. to the ſame Quarter; ſo that in the ſpace of twenty eight years, that declination is increaſed 4 *d.* 15′. In the year 1628, if I remember aright, I found it near 1 degree *Weſtward:* Which declination was affirmed by the Learned *Petrus Crugerus* (once my worthy Præceptor) to have been, about the beginning of this Age, or the end of the next foregoing, 8 *d.* 30′. *Eaſt-ward*; the ſame *Crugerus* alſo making uſe of that Oriental Declination in deſcribing all his Dyals, as may be ſeen in the Tract he hath written of the ſame; though it be not certainly known, by whom, and in what year that Obſervation was made.

Further, It appears by our more recent Obſervations, that this Declination of the Load-ſtone doth here, at *Dantzick*, almoſt every ſeventh year, or, to ſpeak more preciſely, every ſix year and ſeven months, increaſe to one whole degree, and ſo each year, to 9′. 6″. Which is ſufficiently confirmed by the Obſervations made at *Lime-houſe* near *London*, by thoſe three famous Engliſh men, *Burrows*, *Gunter*, and *Gellibrand:* Of whom the *firſt* found the Declination A. 1580. to be 11 *d.* 16′; the *ſecond*, 5 *d.* 36′. 30″. A. 1622; the *third*, 4 *d.* 3′. 30″. A. 1634.

Laſtly, It being now certain, that the Needles Declination *varieth* in one and the ſame place; the accurate Obſervations of the ſubſequent years will ſhew, How far this Deflexion will proceed, and where, and in what diſtance from the true Meridian, the very bounds of this Declination really are; eſpecially, Whether this Libration and Variation will be the ſame, and regular at all times and in all places; or whether, and how long, it will remain Stationary. All which particulars that they may be accurately diſcovered, is a thing very much deſired. Poſſibly conſiderable ſpeculations and reſearches may ariſe from ſuch Obſervations. As for me, I am almoſt of the opinion, that this Magnetical Diverſity comes from the Motion of the Earth. Doubtleſs, as there is a certain Libration in the Moon, ſo 'tis not abſurd to me, to hold a kind of Libration in the Earth, from the Annual and Diurnal motion of the ſame. For that the cauſe of this Declination and Variation of the Load-ſtone is inherent in the Stone it ſelf, or to be aſcribed to Æthereal Corpuſcles, is not imaginable by me; nor can I yet deviſe any cauſe of thoſe Appearances, except we impute them to the Globe of the Earth, and the Variation of the Meridian. But this ſubtile Queſtion I leave to deeper Wits to diſcuſſe. What you in *England* have lately performed in this matter, I ſhould be very glad to be informed of.

I ſhall conclude with acquainting you, that I lately received from one, that liveth on the ſide of the *Baltick* Sea, a piece of *Amber*, which is ſo ſoft, that I printed my Seal on it. It is yellowiſh, as moſt Amber is; tranſparent, and burning as other Amber; but its ſcent ſtronger, as if it were a kind of glutinous *Bitumen*; and yet it hath been caſt up from the Sea this year, and was found among other pieces. His Brother, a very credible perſon, related at the ſame time, that he had been maſter of a ſmall piece of Amber, ſoft on one ſide, and very hard on the other, wherein lay buried a Fly.

A Letter of Mr. Joſeph Childrey *to the Right Reverend* Seth *Lord Biſhop of* Sarum, *containing ſome Animaverſions upon the Reverend Dr.* John Wallis*'s Hypotheſis about the* Flux and Reflux *of the Sea, publiſh't N°. 16. of theſe Tracts.*

My Lord, The laſt Summer I acquainted your Lordſhip, that I had in my mind animadverted ſomethings upon Dr. *Wallis*'s Hypotheſis concerning the *Flux* and *Reflux* of the Sea; which I have at length gotten time to put in writing, and here preſent them incloſed to your Lordſhip. If upon peruſal of them, you ſhall think them worth tranſmitting to Dr. *Wallis*, or communicating them to the *R. Society*, I only deſire your Lordſhips and Their favourable cenſure of my judgment and reaſons.

The

The Animadverſions themſelves.

MY intention is not to argue againſt that part of the Hypotheſis,that relates to the *Common Center of Gravity* of the *Earth and Moon*, and the *Diurnal* and *Menſtrual* viciſſitudes of the Tydes, the Authors diſcourſe being (in my judgment) ſo rational and ſatisfactory as to thoſe, that I cannot ſee what clear objection can be made againſt it. But that which I would beg his leave to except againſt, till better reaſon convince me, is his opinion concerning the *Annual* viciſſitudes, and the true cauſe thereof, which he ſuppoſeth to be quite another thing from the Common center of Gravity, namely the *Inequality* of the *Natural Days*. For I fear he may be miſtaken in the time of the *Annual* viciſſitudes, which he contendeth to be about *Allhallontide* and *Candlemas:* And the reaſons of my fear are theſe;

1. Becauſe, if he dare ſtand to the general judgment of Seamen, which I conceive is more to be truſted than that of the Inhabitants of *Rumney-marſh*, he will (I dare aſſure him) find very few of our Engliſh Seamen of that mind, who uſe to ſay, either that the time of the year ſignifieth nothing at all, or, if it do, that the higheſt Tydes of the year ſeem to happen rather about the *Equinoxes*, than thoſe two other aſſigned times, when the Natural days are longeſt and ſhorteſt.

2. Whereas he gives an inſtance or two (pag.276.) of very high Tydes in the *Thames* in *November* 1660.and 1665; the truth of which we need not queſtion, and of which there are ſundry other the like inſtances in our Engliſh Chronicles; I have reaſon to believe, that thoſe high Tydes proceed from another cauſe, than he ſuppoſeth. For *Firſt*, If that which he ſuppoſeth ſhould be the cauſe, the like high Tydes might be expected every *November*, aud (which is more) they ſhould happen as frequently about *February* as about *November*; of which yet he gives not one inſtance. And (which is yet more, and very conſiderable) though I have peruſed throughly that perfect Collection I have of all the high Tydes in the *Thames*, that our *Chronicles* take notice of ſince the Conqueſt, I can hardly find one ſuch high Tyde in the *Thames* in *February*, or thereabouts. *Secondly*, Thoſe high Tydes in the *Thames* in *November*, if we dare credit the *London*-

Watermen, are cauſed by the coming down of the Land-waters after a very great rain, which being encountred by the Tyde of the flood from the mouth of the *Thames*, cannot but ſwell to an unuſual height: To induce us to believe which, we need only conſider, that the latter end of *October*, and beginning of *November* (or rather both thoſe whole Months) are generally the rainieſt part of the whole year. Now if the great rains fall ſo, that the Land-waters come down to the flowing part of the *Thames*, juſt upon the *Full* or *Change*, when the Spring-Tydes happen, as they did (for example) *Septemb.* 30. 1555, and *October* 22. 1629. (*Stow* and *Hows* are my Authors,) thoſe Spring-Tydes muſt be the higher, as proceeding from a double cauſe. But,

3. (To ſay no more of the *Thames*, but to conſider that and other great Rivers jointly with the Sea,) there is another thing notoriouſly known by all Seamen to be a cauſe of High or Low Tydes, which I cannot but ſay, that I wonder, the Author hath taken ſo little or no notice of in his Eſſay, namely the ſitting of the *Wind* at ſuch or ſuch a point of compaſs, and blowing hard. It is the conſtant ſaying of all Sea-men in *Kent*, that ever I met with, that the North-weſt-wind makes the higheſt Tydes in the *Thames*, *Medway*, and all the coaſts about the *South* and *North-forelands*; and likewiſe on the coaſt of *Holland* and *Flanders*. And the reaſon they alledge for it, is, becauſe (ſay they) *that* wind doth with equal force blow in the Tyde of Flood at both ends of this Iſland of *Britain*, that is, from the North-ward between the Coaſts of *Scotland*, *Norway*, and *Jutland*; and alſo from the Weſt-ward by the Coaſts of *Cornwall*, *Devonſhire*, *Dorſetſhire*, &c. up a long the *Sleeve*; and for the ſame reaſon they ſay (and I think truly) that a South-Eaſt wind deads and hinders the Tydes in the place before mentioned near the *Forelands*. And agreeably to this, (if the teſtimony of Youth may be admitted) I very well remember when I was a boy, and lived at home with my Father at *Rocheſter*, which is near enough to *Chatham*, to obſerve, how the Tydes run there; that when the Tydes were unuſually High, the Wind was always North-weſt, and the Moon near the Full, or Change. And ſo confident I am of my memory in this point, that if enquiry be made about *Chatham*, the *Hundred* of *Hoo*, and the *Iſle* of *Graine*, I believe the Inhabitants will with one voyce ſay, that they never fear their Low Marſhes being

overflowed by the Tyde, but when the wind is at North weſt, or thereabout, upon the Spring-Tydes. Here at *Weymouth* thoſe able and antient Seamen, I have talked with, tell me, that a SSE. wind makes the greateſt Tydes, and that according to the degree of the wind, *cæteris paribus*, the Tydes riſe more or leſs notably; but that they never obſerve any extraordinary ſwelling Tydes about *Allhallontide* or *Candlemas*, unleſs the wind be about SSE. And the reaſon they give for that winds raiſing the Tydes there, is (in my opinion) very convincing, if we conſider the lying of the Haven in the Map. And for the ſame reaſon I ſuppoſe the wind from the ſame point may make the Higheſt Tydes at *Southhampton*; a Weſterly wind at *Briſtol*, and *Severne*; an Eaſterly wind at *Hull*; a North-Eaſt wind at *Wisbych* and *Lyn*; a Southerly wind upon the oppoſite Coaſts of *England* and *Ireland*, &c. And as confident I am, that if more particular enquiry be made in *Rumney-Marſh*, it will be found, that *Dimchurch-wall* is never in danger of being overflowed or broken by the Tydes, but upon very ſtormy and tempeſtuous weather; eſpecially when the Wind either blows right-on upon the Shore, or when it ſits in that point, that raiſeth the Tydes higheſt there. Whether the North-weſt wind (becauſe of the little diſtance of *Rumney Marſh* from the *Forelands*) be the raiſing wind or no, I cannot certainly affirm; but ſo much I believe, that were it not for the running out of the *Neſſe-point* on this ſide (which makes the Coaſt a Bay,) and the running out of *Blackneſſe-point* in *France* on the otherſide, *Dimchurch-wall* would be more ſecure, and need leſs conſtant Reparation than it doth. And if we do but conſider, that *Allhallontide* and *Candlemas* are no more famous for the longeſt and ſhorteſt Natural days, than they are generally infamous for ſtormy weather; eſpecially the former ſeaſon, (wet and windy weather being moſt concomitant,) we have good ground to attribute high Tydes, at thoſe times of the year, to another cauſe, than the Author ſuppoſeth; and make a more than probable conjecture at the occaſion of the miſtake. It is true, *March* is very often more ſtormy than *February* (though ſeldome ſo ſtormy as *October* and *November*) which poſſibly might occaſion that opinion, which ſome hold, (of which number, *Pliny* is one,) that the higheſt Tydes are about the *Equinoxes*. And if the thing were found to hit pretty frequently in *March*, men might not be careful to obſerve the other *Equinox*; though yet it cannot be denyed, that we have bluſtering weather many times before *Michaelmas*. In confirmation of all this, that I have ſaid concerning the influence of the wind's being conſiderable on the Tydes, I ſhall add theſe following Collections of my own out of Hiſtories, Chronicles, &c.

1250. *Octob.* 1. (ſaith *Holinſhead*) upon the change of the Moon, was a moſt dreadful Inundation of the Sea, that did exceeding much hurt to *Holland* beyond Sea, *Holland* in *Lincolnſhire*, and the Marſh ground in *Flanders*, and drowned *Winchelſea*. But he tells us withal, that an un-heard of Tempeſt of wind accompanyed it.

1555. *Sept.* 30. (ſaith *Stow*) was a notable Inundation of the *Thames*; but he ſaith withal, that it was by occaſion of a great Wind, and Rain, that had fallen.

15$\frac{69}{70}$. *March* 10. I find this Manuſcript note in *Latin* in an *Ephemerides* for that year, over againſt the day; *Septentrionis maxima ſævitia: Nivis flocci magni, ingens frigus. Maximè tumeſcebat æſtus maris die & nocte; nam excurrebat in agros laté.*

1592. *Sept.* 6. Wedneſday (ſaith *Stow*) the wind being Weſt and by South, as it had been for two days before very boyſterous, the *Thames* was made ſo void of water, by forcing out the Freſh and keeping back the Salt, that men in divers places might go 200 Paces over, and then fling a Stone to Land, *&c.*

1600. *Decemb.* 8. ſt. v. I find this note written in another *Ephemerides* for that year, over againſt the day, by an unknown perſon, who (as it ſeems) was then at *Venice* (where a South-Eaſt wind makes the higheſt Tydes) *Inundatio Venetiis 6. ped. temp. Sirocco.*

1601. (ſaith *Grimſton* in his *Netherland Hiſtory*) the Sea being forc'd in by a ſtrong N W. wind, did ſome miſchief to *Oſtend*.

1601. *Octob.* 26. ſt. n. a Great tempeſt (ſaith the ſame Author) and the wind Weſt and North-weſt, and the Tyde much higher than uſual at *Oſtend*.

1602. *Febr.* 23, 24. ſt. n. blew a terrible North-weſt wind, which made the water riſe higher than uſual at *Oſtend*. *Idem.*

1604. *March* 1. n. ſt. the wind was very great at Weſt and North-weſt with a furious tempeſt, the Tyde at *Oſtend* riſiug ſo high as it had not done in Forty years before. *Idem.*

4. There is yet another thing, which ſeems to have (at leaſt) ſome influence on the Tydes, and to make them ſwell higher than

elſe they would do, to wit the *Perigæoſis* of the Moon. And this hath been my opinion (taken up firſt upon the conſideration of the Moons coming nearer the Earth) ever ſince 1652, when living at *Feverſham* in *Kent* near the Sea, I found by obſerving the Tydes, (as often as I had leiſure,) that there might be ſome truth in my Conjecture; and therefore in a little Pamphlet, publiſhed in 1653. by the name of *Syzygiaſticon inſtauratum*, I deſired, that others would obſerve that year, whether the Spring-Tydes after thoſe Fulls and Changes, when the Moon was in *Perigæo* (the wind together conſidered) were not higher than uſual. And ſince that time I have found ſeveral high Tydes and Inundations (though I muſt not ſay *all*,) to happen upon the Moons being in, or very near her *Perigæum*. For Example,

1. That famous Inundation, mentioned before out of *Holinſhead*, 1250. *Octob*. 1. was, when the Moon was in *Perigæo*, as appears by Calculation.

2. 1530. *Novemb*. 5. That Inundation on which was made the Diſtick,

Anno ter deno poſt ſeſquimille, Novembris
Quintâ, ſtat ſalſis Zelandia *tota ſub undis*;

was, when the Moon was in *Perigæo*.

3. *Jan*. 13. 155$\frac{1}{2}$. the Sea (ſaith *Michell* in his Chronicle) brake in at *Sandwich*, and overflowed all the Marſhes thereabout, and drowned much Cattel: the Moon in *Perigæo*.

4. 1570. *Novemb*. 1. was a dreadful Flood at *Antwerp*, and on all the Coaſts of *Holland*, that made infinite ſpoyl: the Moon in *Perigæo*.

5. 1600. *Decemb*. 8. above mentioned: the Moon in *Perigæo*.

6. 160$\frac{6}{7}$. *Jan*. 20. was a great Inundation in *Severne*, mentioned in *Howes*'s Chronicle, that did much hurt in *Somerſetſhire*, and *Glocesterſhire*, &c. the Moon in *Perigæo*.

7. 1555. *Septemb*. 30. (forgotten in its due place:) the Moon was in *Perigæo*.

8. 1643. *Jan*. 23. ſt.n. (ſaith a little *Low-Dutch* Chronicle that I have) was a terrible high Water-flood in *Frieſland*, &c. whereby much hurt was done to the Dykes; and at *Gaes* by *Haerlingen* the Dead bodies ſtreamed out of the Earth: the Moon in *Perigæo*.

9. 1651. *Feb*. 23. ſt. n. (ſaith the ſame Chronicle) was St. *Peters* High flood, whereby much hurt was done to the Dykes in

Friezland, *Embderland*, and elſewhere, and not far from *Dockum* by *Oudt-woudumer-ziil* is a breach of 42 roods long broken in the Dyke : the Moon in *Perigæo.*

10. *Auguſt* 2. 1657. ſt. v. at *Feverſham* (where I then lived) was a very high Spring-Tyde, and yet the wind was at South-Eaſt; which deads the Tydes there : the Moon in *Perigæo.*

11. *Auguſt* 22. 1658. ſt. v. at *Feverſham* was a very high Tyde in the After-noon, though the wind was Southerly, and blew very ſtiff, which the Seamen there wondered at : the Moon in *Perigæo.*

12. 1661. Upon *Michaelmas* day was a great overflowing of the *Severn*, that it drowned the low grounds lying by it. I lived then in *Gloceſter-ſhire*, and immediately as ſoon as I heard of it, I noted it down in my memorandums : the Moon in *Perigæo.*

13. The Scheme of the weather printed in the Hiſtory of the *R. Society* tells us, that *May* 24. 1663. was a very great Tyde at *London*. But it tells us withall that the ſame day the Moon was in *Perigæo.*

14 *Sept.* 1. 1669. Here at *Weymouth*, I obſerved my ſelf a very high Tyde; and ſo did ſeveral Seamen in that Town, who wondered at it, the weather being very calm, and that little wind that was being at North-Eaſt, which uſes to contribute nothing at all to the Tydes in that haven : the Moon in *Perigæo.*

Further, that which inclines mee to believe, that the *Perigæoſis* of the Moon is of ſome concernment in this matter, is, becauſe it is a Maxim amongſt our *Kentiſh* Seamen, that they never have two running Spring-Tydes (as they call them) together, but that the next Spring tyde, after a high running Spring, is proportionably weak and ſlack; which, if true, is very correſpondent to my opinion, becauſe if the Moon be in *Perigæo* at this Spring-tyde, ſhe will be in *Apogæo* at the next.

But I conceive the beſt touch-ſtone to prove the ſoundneſs of my opinion (which I confeſs I never had the opportunity to do yet,) is, to have it obſerved, whether thoſe Neap-tydes be not apparently higher (*conſideratis conſiderandis*) that happen at the Moons being in *Perigæo* either at the firſt or laſt quarter : Becauſe it is a received and demonſtrable truth in Aſtronomy, that the Moon being in *Perigæo* at either quarter comes then nearer the Earth, than when it is in *Perigæo* at the Change or Full. And I could wiſh for the further clearing of this matter, that obſervation were made at *Briſtol* (becauſe there is the moſt conſiderable Flux and Reflux of any Port of England,) Whether this year 1670. the Tydes be not higher (*conſideratis*, &c.) when the ☽ paſſeth ♓. ♈. and ♉, than when ſhe paſſeth through the oppoſite ſigns ♍. ♎ and ♏; and particularly whether the Spring-Tydes be not ſenſibly higher after the *Change*, than after the *Full* in *February*, *March*, and *April*; and higher after the *Full* then after the *Change* in *Auguſt*, *September*, and *October*; and alſo, Whether the Neap-tides in *May* and *June* riſe not apparently higher than expected. I am promiſed, the obſervation ſhall be made here at *Weymouth* for this whole year round; from whence I have already received this account, that this preſent *February* $16\frac{69}{70}$. the Spring-Tydes ran very high after the *Change*, though the weather were pretty calm, and that wind that was not very favourable to the Tydes, and that the Spring-Tydes after the *Full* were very low, and weak, which is exactly according to my conjecture.

Dr. Wallis's *Anſwer to the foregoing Animadverſions, directed in a Letter to the Publiſher*, March 19. $16\frac{69}{70}$.

SIR, Yours with the incloſed Animadverſions of M. *Childrey* on my Hypotheſis of *Tydes*, came ſo late to hand on Thurſday laſt (when the Poſt was almoſt ready to be gone) that I had not time, by that Poſt, to give you an account of them. And it is not much, I need to ſay now; for I do not find, that he and I are like much to diſagree.

That the *Winds* have a great influence on the Tydes of particular Coaſts and Havens, according as they are more or leſs ſtiff or ſlack, and blow from this or that part, I do not at all queſtion; but did alwayes take for granted, as generally received, and upon good grounds. And the like I ſay of *Land waters*; which (though as to the Sea they ſignify not much in this point) are, as to In-land Rivers, very conſiderable; eſpecially as to Inundations upon riſing of the Water: Which is rather by Checking than Promoting the Tydes. For certainly, theſe Land-waters, meeting the Tyde of Flood, do hinder it from coming ſo far up the River as otherwiſe it would; and conſequently, if, notwithſtanding ſuch Land-

flouds,

floud, the Tyde flow higher up the River than at other times, this muſt be derived from ſome other cauſe. But, that the Tide and Land-floud ſhould joyntly make a greater Inundation than either ſingly would have done, is not to be doubted. But he need not wonder, that in my *Eſſay*, though I grant both theſe, ~~I ſaid ſo~~ little of either, becauſe it was wholly beſide my buſineſs; which was, to give a *Statical* account of *Stated* Periods (*Diurnal*, *Menſtrual*, *Annual*,) ariſing from Regular Motions; not, of *Accidental* Extravagances, ſuch as theſe are: And therefore I did, in the beginning of that Diſcourſe preclude the Conſideration of the Advantage or Diſadvantage, which ſhould ariſe from ſuch uncertain Contingences, as Extrinſecal to that buſineſs.

His *third* thing ſuggeſted, The *Moon's Perigæoſis*; is ſo far from being contrary to my *Hypotheſis*, that it is a great Part of it. And (if I do not much miſ-remember,) it is, in one of my Letters to you, expreſly mentioned as ſuch. But foraſmuch as it doth not ſtill fall out at the ſame time of the Day, Month, or Year, I could not make it a Component of any of thoſe noted Periods, Diurnal, Menſtrual or Annual; (and of more Periods than theſe, I did not know that there hath been any general notice taken, of which I might think my ſelf obliged to give an account:) but it may very well influence *any* or *all* of thoſe, according as it falls out advantageous or diſadvantageous for them.

And as I do ſo readily concur with him in all the particulars by him ſuggeſted; ſo I think he will not be difficult in aſſenting to all the Materials of my *Hypotheſis*.

The account which I give of the *Diurnal* and *Menſtrual* Periods (from the *Common Center* of *Gravity* of the Earth and Moon,) he doth allow as very Rational: And conſequently (which is the Foundation of it,) that any Acceleration or Retardation of the Compound motion of the particular parts in the Earth's Surface, is to give ſuch an Accumulation of waters as cauſeth a Tyde; and the Complication of ſuch Accelerations and Retardations, concurring or interfering one with another, doth occaſion the perplex Varieties in them: Of which therefore there is no clear account to be given, without conſidering ſeverally the proper Effects of each, from whence doth reſult the Compound Effect of all together.

Now as to the two moſt ſignal motions of the Earth, the *Diur-*

nal and *Annual*; if we ſuppoſe them each in themſelves Equal, and both perfectly circular and upon Parallell *Axes*, though neither of them, ſingly conſider'd, would give an Inequality of motion; yet the compound of both together, being ſwifteſt at Midnight and ſloweſt at Noon, (becauſe the compound of both is, in *that*, the Aggregate, in *this*, the difference of them) would give us two Tydes in each *Diurnal* Revolution: But thoſe alwayes at Noon, and Mid-night.

If to theſe we add the *Menſtrual*, whereby the Earth deſcribes a ſmall *Epicycle* about the Common Center of Gravity of the Earth and Moon; and ſuppoſe this alſo Equal in it ſelf and Circular, about an *Axe* parallell to the reſt: neither would this, of it ſelf, give any Inequality; but, compounded with the reſt, it will. For, *this* compounded with the *Annual*, doth, at the New Moon, *increaſe*; at the Full, *abate* of that motion, as to all parts of the Earth's Surface: But compounded with the *Diurnal* (which, in this caſe, is much the more conſiderable, as recurring every day,) it doth moſt *add* to, or *abate* of, that motion, as to each particular place of the Earth's Surface, when the Moon is in the Meridian of that place, *below* or *above* the Horizon; and would therefore, at thoſe times, give us two Tydes. (For which, and other particulars of like nature, that they may be the better apprehended, I refer my ſelf to the Inſpection of the *Schemes* pertaining to my *Hypotheſis*.)

Now becauſe this coming of the Moon to the *Meridian*, above and below the Horizon, or (as Sea-men call it) the Moon's *Southing* and *Northing*, doth, in a Month's time, paſs round the whole circle of 24 hours; hence it comes to paſs, that the time of the Tydes doth ſo alſo: Which I take to be the true Account of the *Menſtrual* period. And becauſe this Compoſition of the *Menſtrual* with the *Diurnal* (which ſeems by the Effect to be moſt predominant, though not to extinguiſh the other;) caſts the time at the *Moon's* being in the *Meridian*; and that of the *Annual* and *Diurnal*, when the *Sun* is in the *Meridian*: When both theſe happen at the ſame time, as at the Full and Change of the *Moon*; the Tydes muſt needs be the greater: Which I take to be the true Account of the *ſpring-Tydes*, and *Neap-Tydes*. And thus far (which is the main of my *Hypotheſis*,) he concurs with me, as having given at leaſt a very Rational and Probable Account.

If therefore there be no other Periods of Tydes but theſe; or no other remarkable, my work is done, and I need not be further ſolicitous: For, then there will ſeem to be either no other inequality of motions, or none conſiderable. But, if there be alſo obſervable an *Annual* period, (as very many think there is;) or any other ſuch period, (as perhaps there may be,) then are we to ſeek for the Cauſe thereof in ſomewhat of Inequality, which doth (for the *Annual* Period) *Annually* recur; or (for any other Period,) which doth recur in ſuch a time as that other Period doth require.

Now foraſmuch as the three Motions above mentioned are neither (as was above ſuppoſed) each Equal in it ſelf, or perfectly Circular, nor all on Parallel *Axes*; there is, both as to the Sun, and as to the Moon, at leaſt a double Inequality; the *one*, by reaſon of the *Excentricity*, and (which depends thereon) the *Apogæum* and *Perigæum*; the *other*, by reaſon of the *Obliquity* of the Zodiack and the Moon's Orbite, with the Æquinoctial, and with each other. From every of which doth proceed ſome little Inequality of Motion in the Earth's Surface: But whether ſo much as to make any remarkable alteration in the Tydes, is hardly determinable than by obſervation.

Now for that of the *Moon*, both as to its *Apogæum* and *Perigæum*, (with the Inequality of Motion depending on it;) and as to the Obliquity of its Orbe both with the *Zodiack* and the *Æquator* (which cauſeth another Inequality both in the Motion of *Longitude* and *Right Aſcenſion*,) I have hitherto contented my ſelf to inſinuate it, in one of my Letters on this ſubject, without further inſiſting on it; becauſe I did not know of any Periodical Viciſſitude of Tydes conſonant thereunto. When any ſuch ſhall be diſcovered, we have here a Foundation ready for the Salving of it. But as to any *Annual* Viciſſitude, it is not of uſe, becauſe it doth not Annually recur.

But, becauſe it hath been almoſt generally received, That there is an Obſervable *Annual* Period; I did, for the ſalving of that, apply not the *Inequality of the Natural Dayes*, but thoſe cauſes from whence *that* proceeds, the *Excentricity* of the Sun or Earth's Orb, and the *Obliquity* of the Zodiack. The *former* of theſe, if ſingly conſidered, would caſt thoſe Annual Tydes in *June* and *December* (the times of the Sun's *Apogæum* and *Perigæum*, or rather the Earth's *Aphelium*

Aphelium and *Perielium*, when are the ſloweſt and the ſwifteſt Annual motions in the Zodiack :) the *latter*, if conſidered alone, would caſt them upon the two *Æquinoxes*, and the two *Solſtices*, (the times of the Leaſt and of the Greateſt *Right Aſcenſions*:) But if both be joyntly conſidered, they muſt caſt theſe (as they do the greateſt Inequality of the Natural days) at ſome intermediat times, between the *Autumnal Æquinox* in *September*, and the *Perigæum* in *December* ; and again, between this *Perigæum*, and the following *Vernal Æquinox* in *March* : As is more than probable (without the trouble of any new computation) from the greateſt Inequality of the Natural Days, ariſing from the ſame cauſes : But whether preciſely at the ſame time with that Inequality, or whether in all parts of the world at any one time, I do not undertake there to determine ; but rather believe the contrary, becauſe the different Poſition of places may very much alter the Influence of both or either Cauſes. I did only mention, as a thing very notorious, that it doth ſo conſtantly fall out on the coaſts of *Kent*, and particularly of *Rumney-marſh*, about *Allhallontide* and *Candlemas*.

This Account of the *Annual* Viciſſitude is that only, to which M. *Childrey* doth except; oppoſing *firſt*, the Judgement of Seamen (more conſiderable than that of the Inhabitants of *Rumney-Marſh*,) who uſe to ſay, either that the time of the year ſignifies nothing ; or, if at all, it is about the Æquinoxes. Then, that if this be the cauſe, it will be conſtant, and *that* in *February* as well as in *November*. And thirdly, that the Seamen about *Weymouth* have not obſerved any thing ſignal about thoſe Times.

To the *firſt*, I anſwer ; if not then, but at the Æquinoxes, then ſo much of the Hypotheſis as concerns the *Excentricity* may be ſpared, (or allowed to be ſo little as not to be remarkable;) and that of the *Obliquity* alone will give a ſufficient account of it. Or if (to which he ſeems rather to incline,) there be no ſuch *Annual* Viciſſitudes at all ; then may that of the *Obliquity* be ſpared alſo, and the *Hypotheſis* perfect without it. And, till ſome ſuch be obſerved and acknowledged, it will be ſufficient to ſay, That, though both the *Excentricity* and *Obliquity* do cauſe ſome Inequality in the Motion ; yet ſo little, as that in the Tydes it is not remarkable, they falling juſt as if the three Motions, (Annual, Menſtrual, Diurnal,) were all exactly Circular, and on Parallel *Axes*.

To the *ſecond*, which concerns matter of Fact in *Rumney-Marſh*; I ſay, that (according to the beſt account I can there get, and the unanimous conſent as well of Fiſher-men and other Water-men, as of other Inhabitants,) it is conſtant; hardly miſſing (or very ſeldome) any one year (be the weather fair or foul;) and as well about *Candlemaſs*, as about *Allhallontide*, every year, though not then ſo high: Of which (though they do not pretend to give any reaſon of it,) I think a Cauſe may be very rationally aſſigned. For, if you conſult the *Tables* of the *Inequality* of *Natural Days* (which parallel I make uſe of for the Explication of this,) you will find, that about one of the Extreams (in *January*) the Increaſe and Decreaſe of the Natural Days fluctuates very much; ſometime increaſing, ſometime decreaſing, according as this or that of the two Cauſes, thwarting one another, doth prevail: But about the other Extream (in *October*,) it is much otherwiſe; the *Increaſings* and *Decreaſings* going on in a continual courſe for a long time together. And the ſame Cauſes, applyed to the buſineſs of Tydes, may very rationally be ſuppoſed to produce as unequal effects.

To the *third*, That the Sea-men at *Weymouth* have not obſerved any ſuch ſignal Effects about *Allhallontide* and *Candlemas*: It is very poſſible that they have not, and that nothing ſignal on thoſe Coaſts uſeth to happen at thoſe times: For, I fix that matter of Fact principally on *Rumney-Marſh*, (and that it doth there conſtantly happen, I am pretty well out of doubt,) and do but by conjecture extend it to the River of *Thames* (as having its Mouth not far from thoſe Coaſts,) where yet, I think, you can be my Witneſs, that it hath been obſerved ſeveral years to ſucceed accordingly. What variety is on other Coaſts, I am not certain: But (from an Account read in the *R. Society* in my hearing, about the end of the year 1667.) I underſtand that about *Chepſtow bridge* (and conſonantly, I ſuppoſe, on the *Severne* at other places,) they obſerve the like to happen about the beginning of *March*, and end of *September*, (the one as much *before* the *Vernal*, as the other is *after* the *Autumnal* Æquinox, like as in our caſe it happens,) which they call by the name of *St. Davids ſtream*, and *Michaelmas-ſtream*; as we do thoſe in Kent, *Candlemas-ſtream*, and *Allhallon-ſtream*: (And when Sea-men take ſo much notice of particular Tydes as to give names to them, 'tis a great preſumption, that it is for ſome remarkable Accident uſually happening at thoſe Seaſons.) Of theſe different Seaſons at *Chepſtow bridge* from thoſe of *Rumney-Marſh*, I gave you my remarks in a Letter of mine to you in *March* following. And the like differences, I ſuppoſe, will be obſervable on other Coaſts, according as their poſitions be advantageous or diſadvantageous to the one or the other of the two Cauſes, on which this *Phænomenon* depends. But ſince it is not yet (it ſeems) agreed, Whether ſuch an *Annual* Phænomenon do happen; or, if ſo, not at that time; (ſo that, for ought yet appears, it may be at the Seaſons I deſign, that is, between the Winter-Solſtice and the two Æquinoxes on either ſide of it; though, on ſeveral Coaſts, ſeverally remote,) I think it beſt to let this part of the *Hypotheſis* ſtand as it is, unrevoked, as that, which, when it ſhall be diſcovered and agreed on, ſtands ready enough to give a rational account of it, and, in the mean time, does no hurt. And in ſuch a Complication of Cauſes ſo abſtruſe, ſcarce any thing but Obſervation will determine, which of the Cauſes, and in what degree, is to be Judged prædominant.

And if to this of the *Sun*'s or *Earth*'s, be added that of the *Obliquity* and *Excentricity* of the *Moon*'s *Orbite* (of which, for the reaſon above-mentioned, I had taken ſo little notice,) it will, if it do no good, at leſt do no hurt. And I the rather think, it may be conſiderable, becauſe the Earth and Moon's Appropinquation and Elongation, doth really alter the Diſtance of the *Common Center* of *Gravity* (of the Earth and Moon) from the Earth (rendring the Earth's *Epicycle* Elliptical;) and much favors what M. *Childrey* obſerves of the Moon in *Perigæo*. And this is the ſum of what I thought proper to return you, upon thoſe Animadverſions, *being*, &c.

An Accompt of ſome Books.

I. *DISSERTATIONES MEDICÆ TRES: 1. De Cauſis fluxûs Menſtrui Mulierum. 2. De Sympathia variarum Corporis partium cum Utero. 3. De Uſu Lactis ad tabidos reficiendos, & de immediato Corporis Alimento. Auth.* Franciſco Bayle, *Doct. Medico.* Toloſæ, 1670. *in* 4°.

THis Ingenious Author to prepare his Reader to a candid reception of theſe Diſcourſes, repreſents in the Preface, how much miſchief and prejudice hath been done to knowledge *both* by intemperate and blind Love of Novelty, *and* by a ſullen and ſervile addiction to bare Antiquity ; and eſteems him to be truly wiſe, who neither admits Falſities upon the ſole account of being Ancient, nor excludeth Truths becauſe of Novelty, but giveth honor to the Fathers of Sciences, with ſafety to Truth, as *the* thing which the authority both of the Ancients and Moderns ought to ſtoop to. Upon which ground he proceeds, ſometimes diſſenting from *Galen* in theſe Eſſay's alledging, *that* Authors own adviſe and practiſe for ſo doing ; and deploring the unhappineſs of the ſtate of Phyſick becauſe of the too great ſervility of adhering to former attainments. Having premiſed this, he doth in the

Firſt Diſſertation examine and reject the opinion of *Galen* and others concerning the Periodicalneſs or Stated returns of that *Flux* ; eſteeming, that that Author and his Followers do only diſcourſe of what is obvious in this Argument, and leave that unexplained what is not ſo ; as, from what cauſe, by what organs, and why at ſtated times that Evacuation is raiſed and performed. And having ſhew'd, that the common Doctrine concerning this Effect in Women contains nothing, which may be acquieſced in, he proceeds to declare and prove his opinion concerning the ſame, *viz.* That, as in the Earth (the fruitfull womb of all Seeds of Plants,) ſo in all the Wombs of Animals, fit for Conception, there concur chiefly three things: A benigne Heat to cheriſh ; a due Fermentation to agitate and dilate; and a due portion of Moiſture, to enter with eaſe into the paſſages open'd by that Fermenting motion. This he maketh out both in Oviparous and Viviparous Animals, and teacheth, that the bloud being agitated and rarified by that Efferveſcence, ſwels and opens the veſſels, and breaks out into a Profluvium ; *Dumque hoc fervore dilatatur uterus, aperiuntur viæ inconſpicuæ, quibus ſemen maſculinum interius excipitur, quippe quod non hæret in uteri cavitate (in qua Harvæus & alii illud fruſtra quæſivêre) ſed in ipſius ſubſtantiam imbibitur, ubi fæminei ſeminis permiſtione turgeſcit, & radices agit, quibus delatum per apertos fervore meatus ſuccum nutritium accipit: deinde ut in Terra ſolent Plantarum ſemina, caulem profert carneum, Placentam ſcil. uterinam, ex qua fructus inſtar erumpit Ovum, cui ex germine, liquamini innatante, adnaſcitur alia planta mox migratura in animal, tandem in hominem, ſi ex humano ſemine fuerit excitata.*

After this, he inquireth into the Cauſe of that Incaleſcence, and its Periodical viciſſitudes ; as alſo, why 'tis found in

Mulieribus & Si Miis, cùm Equæ, Canes, Vaccæ, &c. non niſi ſeroſum quid idque paucum ab illo uteri fervore profundant. The Cauſe of this Fervor he maketh to be a Nitrous Salt collected in the Body. The reaſon of the Periodical returns he aſſigns to be this, that the *Uterus*, like the Earth, having been throughout fermented and dilated by the nitrous particles, and the orifices of the *Tubuli*, which paſs into the cavity of the ſame, opened, the attenuated bloud ruſheth into it, *indeque foras effunditur. Ubi verò ſanguis liberè fluit, collectum fermentum abſtergit, quemadmodum aqua è Terra, quam abluit, Nitrum ejicit. Reſtituto deinde in ſtatum priſtinum Utero, idem fermentum colligitur eodem modo quo prius, & nî quid obſtet, ſpatio æquali, pari quantitate congeſtum, & ad ſimilem exaltationem evectum, novam efficit in Utero fermentationem.* And this is to our Author the cauſe of that conſtant Circuit: For the Illuſtration of which, he delivers many particulars concerning the collection of Salt in the *Uterus*, and its Fermentative power, and the Fecundity of *Ægyptian* Woemen by reaſon of their drinking the Nitrous water of the *Nile*, &c. To which he annexes an accompt, *Quare ab Uteri Fervore pleræque Animantes tantùm ſeroſum quid & paucum, Mulieres verò ſanguinem profundant? Quare etiam illæ periodi in aliis Mulieribus ſint longiores, in aliis breviores? Ex quo fonte Menſtruæ purgationes ſupprimantur, vel perperam procedant? Quæ mulieres careant Menſtruis ſine noxa; & quàm vegetum robur, quantáq; vitæ longævitas inde conſequatur? Quænam immodicæ vacuationis Cauſæ?* &c.

In the *ſecond* Diſſertation concerning the *Conſent of many parts of the Body with the Womb*, he firſt declareth, that he underſtands by this *Conſent* nothing elſe, but that the parts are at once affected together from one part *principally* affected, and communicating that affection to others. Then having exploded the common opinions touching the Cauſes of this Sympathy, he offers his own, *viz.* the Vicinity of the parts, and the Community and ſtructure of the Veſſels, by which the vitiated liquors of the body being conveyed from one part to another, may there excite the ſame or different affections. But becauſe this way of Sympathiſing by veſſels hath many conſiderable and un-obvious varieties, he takes pains to examine them at large and to give a Scheme of the whole Oeconomy of the Body of the perfecter Animals, conſidering the diverſity and various uſes of the Veſſels, and the neceſſity of Motion and Senſe, depending from the Brain, the Animal Spirits, and the Syſtem of the Nerves, which, being diſperſed through the whole

Body, cannot but produce this Conſent of parts: For the clearer Explication of which, he gives an Accompt of the Order and Dependency of the Veſſels, by which the various Juyces are diſtributed through the Body; and from all theſe together, (taking in the *Structure* of the parts) he deduceth *firſt* in *General*, the manner, How any one part, being affected, communicateth its affection to others; and then in *Particular*, How the Scituation, and the Connexion of the *Womb*, with other parts, is ſubject to produce the like effects: Where he exſpatiateth to declare, How that from the depravation of the Uterine ferment and bloud, ſo many, ſo various, and ſo horrid Diſeaſes and Symptoms ariſe: To all which he adds the ſolution of theſe two Queſtions; 1. Why Sweet ſmells raiſe Hyſterique paſſions; and fœtid ones, remedy the ſame? 2. Why there is ſo ſpecial a conſent of the Womb with the Breaſts? Concerning both which we refer the Reader to the Author himſelf, and proceed to the

Third Diſſertation, in which he inquires, Whence it is, that *Milk* is the beſt Aliment of the Body? And to ſatisfie this Inquiry, he preſuppoſeth, that the proxime nouriſhment is to be as like as may be to the Body to be nouriſh't, and that we ſubſiſt by the ſame things, of which we are generated, and that the Fœtus is fed in the womb, not with Bloud, but a Milky Juyce, taken in at the Mouth, and ſever'd from the Bloud in the *Uterus* by the *Placenta*, as a Strainer; as 'tis in the *Breaſts* by the Glanduls and Tubes deſigned for the ſame purpoſe. And having concluded thereupon, that Meats do not nouriſh before they are converted into a Milky liquor; he Analyſeth Milk, and finding, that its fatty, terreſtrial, and ſerous parts may be eaſily mixed, ſeparated again, and made a fit matter for the different parts of the Body, the Serous part thereof (which is alſo Nitrous) being a very proper Vehicle to conveigh it thorough the veſſels; he infers, that it is the moſt convenient Food, not for Children only, but for Grown people alſo. But becauſe he was aware of divers Objections againſt this Doctrine, eſpecially thoſe two, that are taken from the double Principle of our Generation, the Bloud, and the Genital ſeed; and from the two ſorts of Parts of the Body, Spermatick and Sanguineous: He endeavors to remove both, as may be ſeen in the Book it ſelf; where do occur ſundry curious and conſiderable Anatomical Obſervations and Experiments, grounded upon the Learned Dr. *Whartons* Book of *Glanduls*, and proving, that the

Maternal Bloud is neither the matter of the Aliment of the *Fœtus*, nor that, of which it is firſt formed: all which is illuſtrated and confirmed from the *Phænomena* in *Oviparous* Animals, whoſe young ones, bred in Eggs, receive no bloud at all from their Dams.

But as to the ſucceſſive Changes made in Meats, fit for Nutrition and the production of various Juyces; he repreſents them thus: After that the *Chyle*, produced out of meat and drink in the ſtomach, hath paſſed to the Heart, then the fineſt and moſt Spirituous parts thereof are changed into the red part of the Bloud; ſuch portions as are diſpoſed next, are turned into Bile, and other humors; the remainder is by iterated fermentations with the Bloud in the Heart further digeſted, and perfected, and by being in many places percolated, and leaving behind its ſeroſity, acquireth a glutinous and fibrous nature, like Milk, fitteſt for Nutrition.

So that he concludes upon the whole, That there being no part of the Body, which is not generated of the Seed, and conſequently the Seminal matter being the neareſt Aliment of the ſame, and nothing, of things outwardly taken in, having a greater cognation with it, than Milk, this Liquor is to be eſteem'd the beſt Aliment, and the propereſt to repair tabid and decayed Perſons.

II. *HISTORIÆ GENERALIS INSECTORUM*, Johannis Swammerdani, *Pars prima*. Ultrajecti *A.* 1669. in 4°.

This Curious and Philoſophical Book, written in the *Belgick* Tongue, treateth chiefly of theſe three things.

Firſt, It lays down the Ground of all Natural *Changes* in Inſects; declaring, that by the word *Change*, is nothing elſe to be underſtood but a gradual and natural Evolution and Growth of the parts; not any Metamorphoſis or Transformation of them: which Growth is here made to reſemble, not only the Increaſe of other Animals, but alſo the Budding, Knitting and Spreading of Plants. And here the Author, having taken notice, that, whereas Antient and Famous Writers have eſteem'd and called the *Nympha*, among Inſects, the Change of that Worm, which carries the proper ſhape of the future little Animal; and the *Chryſalis* or *Aurelia* the Change of that Caterpillar, which ſhews no parts at all of the Animal to come; having, I ſay, noted this, deſires the Reader to obſerve, that, whereas he is able to diſcern and to ſhew all the parts or members of the future Animalcle, as well in the *Chryſalis*, as the *Nympha*, he makes no other difference amongſt them, but this, That ſince the parts in a *Chryſalis*, are not ſo plainly diſcernable to our view, as thoſe in a *Nympha*, and becauſe a *Chryſalis* does ſometimes appear of a Gilt-colour, which he hath not hitherto obſerv'd in a *Nympha*, he calls the *Nympha*, barely by the name of *Puppet*, and the *Chryſalis* by that of *Gilt-puppet:* the diſtinction of which is made very clear by the neat and accurate Cuts annexed, and their Explication. In this *Firſt part* is ſet forth the manner, how the *Worms* and *Caterpillars* turn into *Puppets*; and ſhewed, *that* ſome Inſects come perfect out of the Egg, and never out of a Puppet; *that* the principal difference of the *Worm-animalcula*, that turn into *Puppets*, conſiſts in this, that ſome have feet, ſome have none; *that* the breaſt of the feetleſs Worms is never changed; *that* the ſix fore-feet of the Worms with many or ſew feet are never changed or tranſpoſed; *that* the Wings, Horns, Feet, *&c.* grow up under the skin by degrees; *that* in all Worms he can eaſily ſhew the ſaid parts under the skin, affirming, to have done it actually in the preſence of Seignieur *Magalotti*, and Monſieur *Thevenot*, Two very Intelligent and Cautious perſons; and *that* even a *Frog* comes forth into a Puppet.

Secondly, This Book undertaketh to make it out, How the true Ground of the Natural *Changes*, or the Knowledge of the *Nympha* and *Aurelia* hath been obſcured and marred; ſhewing withal, how it is to be cleared and reſtored again. Where he affirms, that *Mouſet* and others do erre about the *Aurelia*, making it neither an Egg, nor an Animal; and that *Harvey* miſtaketh, calling the *Aurelia* (which indeed is the Animal it ſelf,) an Egg, and affirming, that Bloudleſſe *Animalcula* are produced out of *Aurelia*'s by Transformation; whereas the Change, happening in the *Puppets*, is nothing elſe but an Evaporation of the ſuperfluous moiſture. Further, that *Goedartus* erres, holding, that a *Caterpillar* may change before her time; and that, if ſhe ſo changes, ſhe then produceth another Animal: Contrary whereunto our Author affirms, that theſe *Animalcula*, which the ſaid *Goedartus* mentions, as changing againſt the order of nature, do *always* come forth in that manner, *viz.* The Male with wings, and the Female without them: Obſerving further, That *Caterpillars* early forbearing to eat, come only to turn into ſmaller bodied Animals; and adding, that they may change when they will, and that the Animals, when once changed, do never grow bigger. And from the knowledge of the propagation of theſe *Animalcula*, he is of opinion, that we may arrive to that of the Propagation of the reſt of Animals; where he declareth his ſentiment, that there is no *Generation* in Nature, but only a Production by the Growing of parts; adding this aſſertion, that he is able *both* to ſhew all the parts of a *Butterfly* in a Caterpillar, *and* to make the change of the Caterpillar to proceed leiſurely, and ſo to ſtop it in its change, that it ſhall appear half *Caterpillar*, and half *Aurelia*; which he ſaith, he hath actually performed before the now Great Duke of *Toſcany*.

Thirdly, This Author reduceth all *Changes* of Inſects, (ſome few excepted, which he acknowledgeth he doth not yet well underſtand,) into *Four* Claſſes or Ranks; which are diſcriminated by *four* different ways of

Production, Change and Growth. The *firſt* Rank, by him called *Nympha-Animal*, hath a little Animal fully formed in the Egg, which after the evaporation of the ſuperfluous moiſture, comes forth perfect and ſo groweth up; ſuch as the *Lowſe* and *Flea*, &c. The *ſecond* called *Nympha-Vermiculus*, hath the parts of the Inſect imperfectly ſhaped in the Egg, and after hatching acquires its perfection *Viſibly* by outward food; ſuch as the *Locuſt* and *Cricket*, &c. The *third*, called *Nympha-Chryſalis* or *Aurelia*, obtains after hatching, its perfection *darkly*, and not till the laſt caſting of the skin; ſuch as the *Emmet*, and *Night-butterfly*: So that in the *ſecond* and *third* Claſſis not a perfect *Animal*, but a *Worm*, precedes the growing up of the parts; yet with this difference, that in the *ſecond*, the little Creature groweth up manifeſtly; which in the *third* is done obſcurely: The *fourth*, called *Nympha vermiformis*, remains always ſhut up in the skin of the Worm, without a poſſibility of diſcerning the parts, till caſting both skins at once, it becoms capable of generation; ſuch as the *Fly*.

In the Explication and Deduction of all which differences, the Author taketh notice of many remarkable particulars: *E.g. That* the Inſects, which come perfect out of their Eggs, change only by caſting their skin; and thoſe that come forth imperfect, do, beſides skin-caſting, grow up by food, to become *Nympha*'s or Puppets: *That* thoſe, which come perfect or imperfect out of the Egg, are in the Egg firſt like Puppets, and undergo, both of them in the Egg, all the alterations, which any Inſect undergoeth in the Puppet: *That* the parts of *Puppets* protuberate, much like the Budding of Flowers: *That* the *Caterpillar* is the *Butterfly* it ſelf, only covered over with a mantle, whereby the parts are kept from our diſcerning: *That* the doctrine of Seigneur *Malpighi*, in his Diſſertation de *Bombyce* (dedicated to the *R. Society*,) concerning the Change of *Butterflyes*, is true: *That* innumerable Inſects fly about and feed by night, as well as others do by day: *That Snails* diſcharge their excrements by the neck, and are each of them, both Male and Female: *That* from *Caterpillars*, feeding on ſuch and ſuch plants, conjectures may be drawn concerning the agreement of the reſpective qualities of them; it being very probable, that, if thoſe Creatures do eat of ſeveral plants (each ſort of thoſe Inſects being eſteem'd, to feed but on one ſort of Vegetables) thoſe Plants do agree in their nature and vertues, *&c.*

Thoſe Inſects, which the Author can as yet reduce to no *Claſſis*, are;

Cicindela.
Scolopendra.
Julus.
Curculio.
Scarabæus pilularius.
Hydrocantharis.
Hydrocantharis minimus.
Scorpio.

III. *The* CREED *of M.* HOBBES, *Examined by M.* Teniſon. London, 1670. *in* 8°.

PAſſing by the ſeveral particulars, which concern *Morality* and *Policy*, diſcuſſed in this Book, as not belonging to theſe Tracts, which are principally deſigned to give an Accompt of ſuch Occurrences as are of a Phyſical and Mathematical nature ; We ſhall only take notice of the Ingenious Confutation, made by this Author, of what M. *Hobbes* hath delivered concerning the *Rational Soul*, and *Perception* in *Matter* ; Where (in my opinion) it is ſtrongly evinced, That the *Soul of man* is ſomething elſe, than the Organized Body in due motion ; and that 'tis altogether unconceivable and therefore moſt un-philoſophical, that *Matter* ſhould be capable of Perception, Cogitation, and Diſcourſe. In the doing of which, our Author deſcends to particulars, making it out, that *Senſation* is not made by Motion or Reaction in meer Matter ; nor that Imagination, Memory, much leſs Reaſon, are meerly Mechanical ; refuting alſo that Dogme, which maketh Reaſon nothing but an apt joyning of *Names*. All which ſeems to be performed with ſo much force, that it appeares not, what in reaſon can be rejoyned thereto ; which yet is not ſaid without a ready ſubmiſſion to better judgments.

IV. *FRANCISCI JOSEPHI BURRHI Epiſtolæ duæ ad Thomam Bartholinum.* Hafniæ, 1669, in 4°.

THis ſmall Tract being but very lately ſent out of *Denmark* to the Publiſher, he thought fit to give forthwith the following Accompt of it.

Theſe two Letters of Signeur *Burrhi* are an Anſwer to two others, which M. *Bartholin* had written to him touching ſundry conſiderable and curious Subjects of Natural Philoſophy and Medicine.

In the *former* he endeavours to explain, How the *Brain* is formed, and what kind of Subſtance it is. In the doing of which he obſerveth, That as many Salts, diſſolved together in common water, are ſever'd by a ſimple Diſtillation ; and as divers Mettals melted together into one maſſe are un-mixed from one another, when a certain degree of heat is given them ; ſo the different parts, which conſtitute the *Seed*, although they be ſo blended together that 'tis impoſſible to diſtinguiſh them, do diſ-engage themſelves from one another when they are agitated by a competent Heat ; and taking the ſituation which is natural to them, give riſe to the ſeveral Organs of the Body. The direct and the moſt maſſy, by their weight going to the Center, form the *Heart* ; the ſpongious, the *Lungs* ; the bituminous, the *Liver* and the fatty and oily, as the higheſt, riſing above the reſt, form the *Brain*, &c. Where he takes notice, that *Hippocrates* holds the Brain to have little of Oylines in it, becauſe it will not flame ; whereas he aſſures, that having diſtilled the Brain of a Calf, he drew from it a conſiderable quantity of Oyl : which (to note that by the by) being applyed outwardly, is by him recommended as excellent to appeaſe the pains of the *Gout*.

In the ſame Letter he affirms, that in the Brain there is made a certain very ſubtile and well-ſcented liquor, which he believes to be the Seat of the Reaſonable Soul ; and that the Wit of men depends on the Temper of this Liquor, rather than from the Conformation of the Brain: Which he confirms by the Example of one, who by taking great ſtore of *Tobacco*, had ſo dryed up his Brain, that after his death there was found in his Head but a very ſmall black clod, compoſed of ſundry membrans; and yet his Soul had not been wanting to perform her functions to the laſt.

He alſo takes occaſion to diſcourſe of *Reſpiration*, adventuring to affirm, that Reſpiration is cauſed by divers liquors, which riſing through the Veins into the Heart, and there fermenting, ſend to the Lungs ſuch Vapors as attract the Air: For illuſtration whereof, he ſaith, That, if to a Glaſs-bowl, hollow and with a ſmall hole, you ſodder divers Pipes of Glaſs half full of different ſtrong Liquors, the Vapours, elevated from thoſe Pipes in the glaſs-bowl, will draw the Air after the ſame manner as tis drawn into the Lungs by Reſpiration.

In the *other* Letter, he treats of the way of curing ſeveral Diſtempers of the Eyes, and particularly of ſome ſurprizing ones, cured by himſelf. Where he affirms, that, having cut aſunder the Apple of the Eye of divers Animals, and ſqueeſed out the humors, even the *Chryſtallin* it ſelf, he hath reſtored the ſight to thoſe Animals; and that the Eyes of thoſe Birds, on which he had made this Experiment, looked better and more vivid than before; and that he had performed this operation upon many perſons with ſo much ſucceſs, that in their Eyes there remained not the leaſt appearance of a Scar. After this relation he is not ſhy to teach the way of making this Operation, adding the cautions to be obſerved therein, and withall the Remedy it ſelf; which conſiſts chiefly in a certain Water of *Celondine*, and a Phlegme of *Vitriol* of *Mars*.

On the occaſion of teaching the Preparation of this remedy, he taketh notice of ſeveral particulars, perhaps not to be deſpiſed: Firſt, That if about a pint of Water be poured on ten pounds of Filings of Iron, freſh and fine, and after having well ſtirr'd it with one's hand, you cover the veſſel, wherein it is, and wrap it about with ſome dry ſtuff, theſe Filings will, within the ſpace of an hour and an half, ferment and grow hot, like *Calx viva*. Secondly, That having often quenched in Water an Ingot of fine Gold, heated red hot, he hath found the weight of that Gold notably diminiſh't; and having afterwards ſuffered the Water to evaporate, drawn a little Gold thence; which (he ſaith) ſhews, that the moſt ſubtile parts of the Gold paſs into the liquors, wherein it is quenched; whence it is (he adds) that ſuch liquors have admirable vertues, to cure many Diſeaſes: And amongſt others he pretends, that in *Dyſſenteries* there is no better Remedy, than Roſe-water, wherein Gold hath been quenched. Thirdly, That in the Reſolution of *Simples*, an excellent means of preſerving their proper virtues is, inſtead of uſing Fire or any other ſtrange Heat, which might alter their vertues, to employ only the Warmth of an Hot-bed made of the Putrefaction of the Herbs of the ſame *Species* with thoſe you would Diſtil.

LONDON,
Printed for John Martyn, *Printer to the* Royal Society.

BRITISH MUSEUM
NATURAL HISTORY

Stella in Cygno
obseruata á
Joh. Hevelio
Anno 1670. die 25 Julij st n

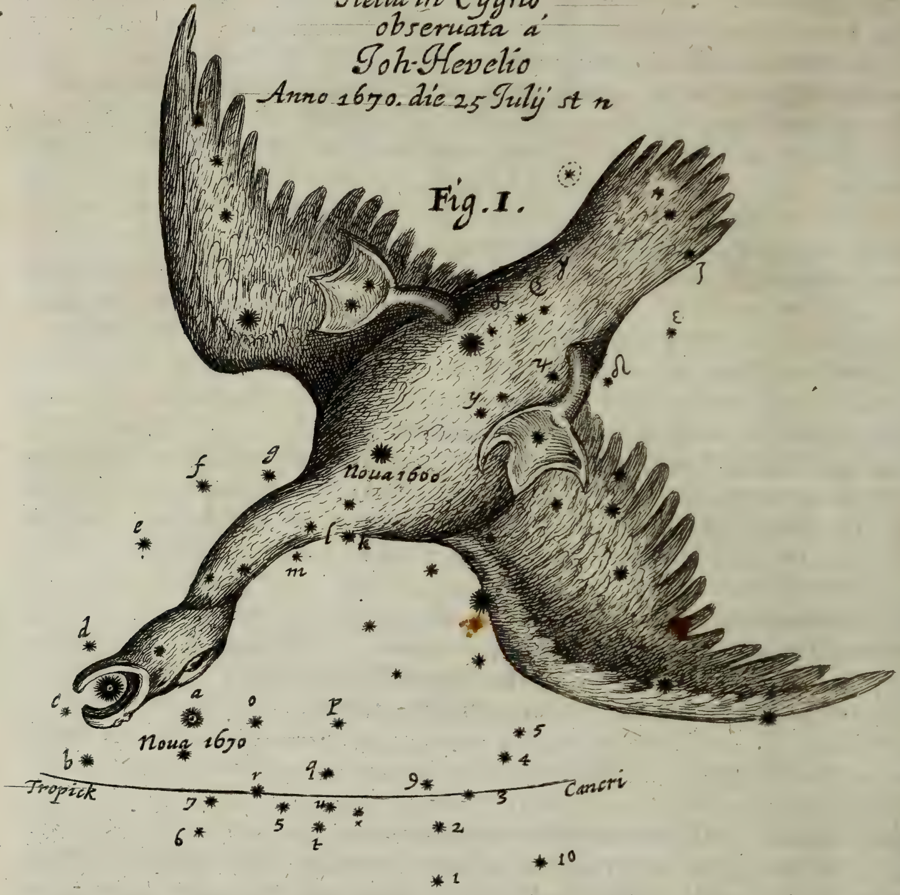

Fig. I.

Saturnus Obseruatus
GEDANI
Anno 1670. die 26 August.
Joh. á Heuelio.

Sat. obs. Lond.
á R. Hook.
Septembr $\frac{26}{16}$ 1670.

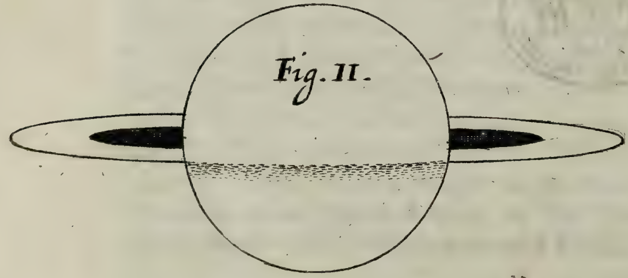

Fig. II.

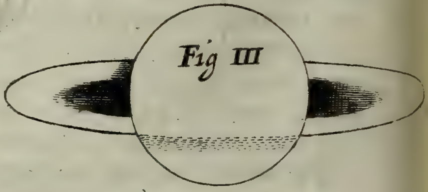

Fig III

PHILOSOPHICAL TRANSACTIONS.

Novemb. 14. 1670.

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An Extract of a Letter, written to the Publiſher out of France, *Octob.* 29. 1670. *intimating two New* Anatomical *Diſcoveries.*

A Friend of mine, a profeſſed Phyſitian, hath aſſured me, that at *Montpelier*, a *German* hath diſcover'd the veſſels, which convey the Chyle to the Breaſts of Nurſing Women; and ſhew'd, that they do iſſue out of the *Ductus* of Monſieur *Pecquet*. This is a diſcovery of a thing, the *being* of which hath been believed long ſince, though not made out. Another perſon hath aſſured me, that there is certainly another paſſage of the Urine to the Bladder than by the Ureters; an Experiment having been lately made, whereby the Ureters of a Dog were ſo carefully tyed up, that nothing could paſs that way, and yet the Urinary Bladder was found full of Water.

A Narrative of divers odd Effects of a dreadful Thunder-clap, at Stralſund *in* Pomerania, $\frac{19}{29}$ *June* 1670; *taken out of a Relation, there Printed by Authority in High Dutch.*

After a very hot ſeaſon from the beginning of this month of *June*, on the $\frac{16}{26}$ of the ſame, early in the morning a great Tempeſt was obſerved, gathering Weſt-South Weſt, of which there appear'd much Lightning, with ſome Thunder only as a far off. On the nineteenth (being Sunday) after ſeveral leſs ſtrong reports of Thunder, the whole Town, and particularly the Congregation in St. *Niclas* Church (when the Miniſter was Preaching) was ſtrangely ſurpriſed with a moſt terrible flaſh of Lightning and a fearful Thunder-clap, which lighted down through the leſſer ſteeple upon the body of the Church, and through the round large hole in the upper Vault within the ſame, in the ſhape (as ſome obſerv'd) of a black fiery ball, directly upon the Altar, cauſing ſuch an hideous crack, fire-flaſh, ſmoak and damp there, as if many fire balls had been thrown down thither from the ſaid Vault, and burſted all at once; begetting a diſmal conſternation among the people, and leaving an ill Sulphureous ſmell behind.

The Candle on the South-ſide of the Altar was put out by the blow, the other remain'd burning. Two of the Chalices there, were overthrown, and the Wine Spilt, and the Wafers ſcatter'd about; but the empty Chalice ſtood firm. All three were ſomewhat ſmutted at the foot, and one of them a little bent there, and in two places pierced through as if it had been by hail-ſhot: And the Wafer-boxes were likewiſe a little ſmutted towards the bottom. The Church-book was flung on the inner paſſage: The Covers of the Altar were ſinged in divers parts, as by powder, and ſomewhat burnt and ſmutted here and there, as alſo torn in ſome places. A ſtrong piece of Wainſcot, with a Picture upon it, behind the great Altar, was ſplit in two. Of the Church clock, in the Weſt end, at the ſame time, both the Braſs and Iron-Wires of the whole and quarter-hours hammer was partly broken, and the reſt could not be found; and an Oaken Poſt fixt in the wall for the ſupport of the Dyall, was half torn, and beneath the ſame divers Bricks were ſtruck out of the two Head-Pillars ſupporting the Steeple. On the top of the Southern ſteeple, an Oaken Gutter, and a ſtrong Beam and Supporter were ſhatter'd, and fell dangerouſly, but that one part of it held faſt yet by one Nail.

One of the Miniſters, though ſitting near the Altar to the South, had no hurt at all. Divers of the people ſeated round about the Altar fell down to the ground with the fright One Youth, that ſtood next the ſaid Miniſters Pew, not being able to recover his ſences, was carried home. On the North-ſide of the Altar, four perſons fell down, and one of the Oaken Seats being ſplit under him that ſate thereon, that perſon was much hurt by it, and more than any other. Some that ſtood in or by the Belfree, near the Clock, were ſlightly hurt here and there; and among them a Mariner, leaning on a lined oaken Seat there, had his right arm bruiſed; and another man though but ſlightly hurt, yet could not remember, how he got home from Church.

The Sermon being broke off, and the people making haſt away, ſome obſerv'd, that there iſſued forth a huge Damp out of the Southern Steeple, like unto Smoak which poſſeſſed many with great fears of Fire within; but the Church-Carpenter, upon ſearch of the ſaid Steeple and Church-roof within, met only with a preſent noiſe and thick damp, which, though it frighted him at firſt into an apprehenſion of Fire indeed; yet, getting to the Windows, and opening them, the damp iſſued with great violence, but there appear'd no Fire any where, ſave only a little in the ſhatter'd parts of the Steeple, which was ſoon quenched.

The Church-Dyall was alſo much ſmutted in ſundry parts, ſoiling the gilt figures that they could ſcarce be diſcerned. The gilt Weather-cocks, upon both the Steeples, were likewiſe ſmutted on the one ſide of their Tayles, without any other mark. Nor could it be in the leaſt diſcover'd, in either of the Steeples, which way the Claps entred, by all the ſearch that was made.

Among the perſons, that were any way hurt, (who were but *eight* in all) divers notable particulars were obſerved afterwards, *viz.*

One, that ſtood in the Bel-free, had the upper back-part of his Cloth-coat, as alſo his ſhirt and skin, ſomewhat torn; but the lining of that Coat, which was red-frieze, had no hurt at all, betwixt the reſt.

Another, ſitting in a Pew under the Organs, and leaning on the door, whileſt the Pew-lock (then cloſe to his body) was ſo violently ſtruck out, that it hung only by one Nail, had no dammage at all by it himſelf, nor any other that ſate or ſtood by there, when the ſtroak happen'd, though they fell all to the ground by the fright, at the inſtant when it was given.

And as for him, that had his Arm bruiſed, it was ſomewhat ſtrange, that afterwards there was found a hole paſſing his coat, waſt-coat and ſhirt on the fore-part of his Body, without in the leaſt hurting the Body; the hole appearing juſt as ſhot through. And beſides, notice was taken, that the ſaid man's Waſt-coat (being of a red Sarcenet) kept its colour every where, but at the place where the Arm was hurt; and the waſt-coat being edged with a ſmall Silver-lace, the lace was ſmutted almoſt every where, and about the neck too, where the party wore a Cravate. The ſame perſon had alſo one half of a ſhoe torn off, the ſoal being pierced as with hail-ſhot; and a piece of his ſtockings foot on the ſame foot ſtruck away, near an hand-breadth; without any other hurt to either foot or leg, but that for ſome dayes that foot was benummed.

Laſtly, one of them that ſat by the Altar, had his Breeches and Leather-drawers on both ſides pierced through, as by hail-ſhot, and part of it plainly ſcorch't and ſhrunk up, as by fire; and divers of ſuch ſmall holes in his ſhirt too, yet without any hurt in his body; ſave, that he found ſome pain in his foot. One ſide of his ſhoe alſo was half torn, and the Soal ſidewards pierced through, as 'twere, with hail-ſhot.

Yet there dyed not any one of all them that were hurt; they recovering either of themſelves, or by the advice and help of others.

An Extract of a Letter of M. *Hevelius*, written to the Publiſher from *Dantzick*, Auguſt $\frac{17}{27}$ 1670. Concerning a *New Star*, lately diſcover'd in the Conſtellation of the *Swan*, together with the preſent Appearance of the Planet *Saturn*.

E*Tiamſi non dubitem, ultimas meas Tibi eſſe traditas, nihilominus tamen hiſce Te rurſus inviſere volui, quo vos de Obſervatione quadam notatu digna certiores facerem, mentemque ſimul meam ea de re vobis exponerem: De* Nova *videlicet illa* Fixa *circa* Cygnum, *nuper deprehensâ; non quidem de illa, quæ in* Pectore *ejus jam Anno* 1600 *illuxit, & Anno* 1660 *rurſus evanuit, ac denuo Anno* 1666. *menſe* Septembri, *inſtar ſtellulæ* Septimæ *magnitudinis emicuit; de qua eo tempore, ſi rectè memini, ſuſius vobis perſcripſeram: Sed de Fixa prorſus diverſa,* Tertiæ *magnitudinis ferè, circa & infra caput* Cygni, *inter informes conſpicua, cujus Longitudo* 1°. 52'. 26'' ♒, *& Latitudo* 47°. 25'. 22''. Bor. *modò exiſtit, ut Obſervationes, die* 25 Julii *à me habitæ, luculenter oſtendunt.* Novam *autem ſtellam hanc ipſam omnino eſſe, & in Cœlo ad annum* 1660 *penitus inconſpicuam fuiſſe, non eſt quod quiſquam dubitet. Nam, ut noſti, à plurimis jam annis, &* Planetarum & Fixarum *obſervationibus maximè (quod præfiſcine dixerim) operam dedi, ſic ut non ſolum omnes illas à* Tychone *olim obſervatas, globóque adſcriptas, ſed & reliquas hactenus neglectas, nudo tamen oculo bene conſpicuas, tum* Quartæ *tum* Quintæ *tum* Sextæ *magnitudinis, in quibuſvis Aſteriſmis accuratè notarem, inque catalogum referrem: quo imposterum eo facilius, ſi qua* nova *prodiret Fixa, deprehenderetur. Accidit igitur, ut Anno jam* 1659, 1660, *&* 1661, *pleraſque ſtellas*

las illas omnes, in Aſteriſmo Cygni apparentes, ſummâ diligentiâ debitis Organis dimenſus fuerim, atque ita omnes illas, etiam circa Collum, & Caput deprehenſibiles, notaverim, earumque diſtantias à diverſis fixis ceperim; nullam autem ſtellam tertiæ magnitudinis, eo loco, ubi jam dicta nova notatur, tum deprehendi; quam tamen optime, ſi adfuiſſet, conſpexiſſem. Nam cum (ſub nota 6.7.) in delineatione noſtra, ſupra ſcilicet cuſpidem alæ Borealis Aquilæ, & quidem multo minores, tum [b] duarum informium, Caput Cygni precedentium, inferiorem, tum ipſum Caput ſextæ Magnitudinis, nec non c,d,n,m,l k, Stellas Sextæ & Quintæ magnitud. probè ac diſtinctè viderim; quidni etiam hanc ad duos treſve gradus ab his remotam, & quidem Tertiæ magnit. obſervaſſem? Sic ut primò hinc certus ſim, Anno 1660 & 1661 hanc ſtellam nondum extitiſſe viſibilem. Deinde, clarè etiam patet ex Bayeri Vranometriâ, hanc modò dictam novam Stellam neque Anno 1603. apparuiſſe, & per conſequens neque Tychoni multo minus Hipparcho. Siquidem & Bayerus Fixam tantæ magnitudinis deprehendiſſet, cùm haud procul ab illa aliam (ſub numero 8.) in meo Schemate Sextæ Magnit. depinxerit: prout in Aſteriſmo ejus Cygni videre eſt. At, inquies, fortè ea ipſa eſt quam tu novam dicis quippe cùm Bayerus congruis organis ſtellas illas haud obſervaverit fieri facilè potuit, ut à vero ejus loco ad gradum, vel paulò plus, aberraverit. Sed crede id factum non eſt; quandoquidem ſtella illa parvula (8) adhuc eodem loco, ubi Bayerus ferè eam depoſuit, commoratur, nec major eſt ſtella ſextæ magnitudinis, ut eodem tempore ei videbatur. Diſtat enim, ut ipſemet nuper deprehendi, ab ore Pegaſi 32°. 39'. 0''; dextro genu Pegaſi 39°. 32'. 45''; hinc provenit ejus Longitudo 0°. 6'. 28''. ♒, & Lat. 46°. 11'. 14''. Bor. ad annum ſcilicet currentem 1670. complet. Julio. At nova [a] elongatur ab ore Pegaſi 32°. 31'. 35'', & à dextro genu Pegaſi 38°. 18'. 50''; ex quibus diſtantiis Longitudo 1° 52'. 26''. ♒, & Latitudo 47°. 25'. 22''. Boreal. elicitur. Adeò ut hæc Nova planè ſit diverſa ab illa Sextæ magnitudinis, à Bayero notata; (quanquam hæ duæ nondum ad duos gradus ab invicem removentur.) Atque ex dictis manifeſtum fit, hanc Novam nec anno 1603. nec anno 1660. inter cœteras emicuiſſe ſtellas. Quò autem Aſtrophili eò diſtinctiùs tum ſtellam illam, tum locum ejus cognoſcant, volui totum Cygnum, (Vid. Tab. 1. Fig. 1.) cum adhærentibus ſtellis, nec non omnibus illis minoribus, Globo hacterus nondum adſcriptis, ac à me per diſtantias varias ſedulo obſervatis, delineatam dare, ac Illuſtriſſimæ Societati quantocius tranſmittere; ut ſimul conſtet, quot incognitis Fixis Aſteriſmos omnes, divina ope, hucuſque jam ditaverim ac exornaverim. Ego ſolo Cygno 35. addidi; quippe Tycho non niſi 18. in ſuo Catalogo exhibet, quibus Kepplerus 8 addidit, ſic ut Conſtellatio Cygni in Globo noſtro 60. ferè ſtellis fixis nunc luceat. De cætero, bene impoſterum attendendum erit, an ſæpius dicta Stella [a] in eadem magnitudine ſit permanſura; an verò ratione magnitudinis luminiſque diverſam aliquam induerit faciem? Cùm primitus à me obſervabatur, quoad magnitudinem & ſplendorem, ſtellæ in Pectore Aquilæ æquabatur, niſi quòd aliquanto obtuſioris fuerit luminis; quoad ſitum, reſpectu reliquarum ſtellarum, in linea rectâ cum illa in Ancone alæ ſuperioris Cygni, & illâ in humero Aquilæ, nec non cum lucida Lyræ, & illâ in Rhombo Delphini, mediarum Borealiori conſiſtebat; triangulum verò æquilaterum cum illa in Capite & Roſtro Cygni conſtituebat. Altera verò illa Nova in Pectore Cygni, quæ rurſus, Anno 1666. illuxit, ſenſim creſcere videtur, quanquam necdum major eſt ſtellis ſextæ magnitudinis, ac minor adhuc illis tribus, m, l, & k, in Collo à me obſervatis. At illa in Collo Ceti, non maximè ſplendet; quippe Secundæ ferè magnitud. tum inſignis claritatis videtur.

Vltimò, cùm heſterna die, (26. Auguſti) optimam occaſionem nactus fuerim; cœlo admodum annuente, Teleſcopium illud, 50. pedes longum, quod non ita pridem mihi tranſmiſiſtis, ad ſidera adhibui, & quidem primo ad Lunam; inveni, quòd officio ſuo adeò ſatisfaciat, ut meritò habeam, cur vobis maximas agam gratias. Ad Saturnum, ut Luna fuerit præſens, ſatis ſuperque vires etiam ſuas extendit; ſiquidem faciem ejus nitidiſſimè ac clariſſimè detegebat. Quali autem mihi apparuit, adjecta delineatio (Vid. Tab. 1. Fig. 2.) commonſtrabit. Videbis Saturnum hoc tempore, altâ ſcil. Aquila 24°. 32'. 0". in diſtantia ab extrema Alæ Pegaſi 23°. 48'. 0". & ab Ore ejus 24°. 51'. 40". in 4°. 11'. Piſcium, in 1°. 53'. Latit. Auſtr., in ipſa, nempe oppoſitione Solis exiſtente Saturno, planè alia *facie, quàm Cl.* Hugenio, *tum* Vobis *Anno* 1666. *tum* Pariſienſibus 1668 *apparere. Siquidem* Annulus, *qui* Saturnum *circundat, multo nunc arctior, compreſſiorque animadverſus, quàm illo tempore, quaſi obliquiori, reſpectu Terræ, nunc viâ incedat. Non dubito, ſi Veſtrates illum nuper obſervarunt, quin eadem formâ iis quoque apparuerit; nam ſummâ diligentiâ illum adumbravi.*

Nomina Stellarum Cygni à Tychoni obſervatarum.

		Magnit.
	Roſtrum Cygni	3.
	Nova Pectoris A.1603, à Keplero obſerv. 3 magn.	6.
V.Tab.1.	Pectus	3.
Figure 1.	Cauda	2.
	In Ancone aleæ Boreæ	3.
	In Ancone alæ Auſtr.	3.
	Extrema alæ Auſtr.	3.
	In Capite	5.
	In medio Colli	4.
	Extrema & Suprema alæ Bor.	4.
	Penultima ſ. Media	4.
	Antepenultima ſ. infima alæ Bor.	4.
	In Boreo pede præcedens	4.
	ſequens	4.
	In Auſtrali pede præcedens	4.
	ſequens	4.
	In principio alæ Auſtr.	4.
	In vola alæ Auſtr. Bor.	4.
	Media	4.
	Infima	4.
	In Cuſpide alæ Auſtr.	
	Informium ſub ala Auſtr. Auſtralium præcedens	
	ſequens	lit.
	Duarum informium caput Cygni præcedentium inferior	*b num.*
	Supra Cuſpidem alæ Bor. Aquilæ Auſtr.	6.
	Borealis	7.

Nomina Stellarum Cygni à Joh. Hevelio Obſervatarum.

	Magn.	*Lit.*
Duarum informium, caput Cygni præcedentium, ſuperior.	6.	*c.*
Ad Genam Cygni	5.	*d.*
Nova ſub capite Cygni in via Lactea, trium ſuperiorum præcedens	3.	*a.*
Media	5.	*o.*
Ultima	5.	*p.*
Sub capite Cygni in via lactea ſub ipſo Tropico	5.	*r.*
Sub cap. duarum inferiorum ſup. Tropic. ſeq.	5.	*q.*
Infra lucidiorem Colli	5.	*n.*
Supra lucidiorem Colli trium præcedens	5.	*g.*
media	5.	*i.*
ſequens	5.	*m.*
Sub nova Pectoris prima	6.	*l.*
ſecunda	6.	*k.*
Informis in via Lactea præcedens collum	5.	*f.*
In Cuſpide alæ Vulturis	5.	*e.*
In ſuperiori parte Ventris præcedens	5.	*y.*
ſequens	5.	ψ.
Infima Ventris	5.	α.
In eductione Caudæ præcedens	5.	β.
ſequens	5.	γ.
In Extremitate Caudæ Borealis	5.	η.
Auſtral.	6.	ζ.
Infra pedem Auſtrinum	5.	δ.
Infra Caudam informis	5.	ε.
Supra Caudam nebuloſa	6.	θ.
Supra ſagittam & ſub Tropico trium præcedentium	5.	*s.*
media	6.	*u.*
Supra ſagittam Auſtral. & proximior	6.	*t.*
Supra ſagittam & ſub Tropico trium ſeq.	6.	*x.*
Supra Delph., alam Auſtr. Cygni verſus, inferior & prima	5.	1.
ſecunda	6.	2.
Sub ipſo Tropico tertia	6.	3.
Supra Tropicum quarta	6.	4.
Ultima ſive quinta	6.	5.
Informium ſupra Delph., mediam ſub ipſo Tropico præced.	6.	9.
Informium ſupra Delphinum, inferiorem ſequens	6.	10
Sub Capite, *novam* [a] præcedens	6.	8.

An Accompt from Paris, *in two Letters to the Publiſher, dated July* 5. *and July* 19. 1670. *concerning the Earlier Diſcovery of the ſame* New Star, *which is deſcribed in the Precedent Letter.*

THe Letter of July 5. 1670. relateth, that a *Carthuſian* of *Dyon*, having from time to time for divers years taken particular notice of what might occur remarkable in the Conſtellations of *Cygnus* and *Caſſiopea*, did on the 20th of *December* A. 1669. diſcover a Star of the *Third* magnitude, beneath the Head of *Cygnus*, ſcituated in the Section of the two ſtraight lines, one of which goeth from *Lyra* to the neareſt of the Quadrangle in the *Dolphin*, and the other from the *Eagle* to the Star, which is on the top of the upper wing of *Cygnus*.

That of July 19. 1670. gives this Accompt, *viz. That* there was much diſcourſe at *Paris* about the *New Star* near the Beak of *Cygnus* firſt diſcover'd by a Carthuſian of *Dyon*, call'd *Antelme*, who ſent the news of it to M. L'Abbé *Mariotte*, one of the Royal Academy there, who had communicated it to the reſt: *That* they all agree, 'tis a *New* Star; though Monſ. *B.* oppoſed it at firſt, affirming it to be in *Bayerus*'s Tables. *That* they prove that Star in *Bayerus* to be another; giving, for diſtinguiſhment, theſe Meaſures.

The bright Star *ad Roſtrum Cygni* its Aſcenſio recta	289°.22'.0".
Declinatio Borealis	27. 19.20.
But this *New* Star's Aſcenſio Recta is	293.33. 0.
Declinatio Borealis	26.33.20.
Longitudo	1. 55 ♒.
Latitudo	47. 28.10.
It's Diſt. from that ad *Roſtrum Cygni* towards *jaculum*	3.47.

Some

Some Communications, confirming the preſent Appearance of the Ring about Saturn, *by M.* Hugens de Zulechem *and Mr.* Hook.

THe *former* writeth in a Letter of his, dated at the *Hague* Octob. 31. 1670. ſt. n. That he obſerv'd *Saturn* with his Teleſcope of 22 feet, a little before he came out of *France*, which was the laſt Summer of this 1670. and ſaw his Figure to be very conform to what it ſhould be according to his *Hypotheſis*; *viz.* the *Anſæ* or Arms to be very narrow, inſomuch that their opening appear'd not but very obſcurely.

The *Latter* hath obſerved the ſame in *London*, Septemb. 16. ſt. v. as is repreſented in *Tab.* 1. *Fig.* 3.

An Extract out of a lately Printed Epiſtolary Addreſs, made to the G. Duke of Toſcany *touching ſome Anatomical Engagements, of* Laur. Bellini, *Ord. Anat. Prof. at Piſa.*

I Promiſe (ſaith that learned Anatomiſt) to give the whole Doctrine of *Reſpiration*, and to comprehend it in that order, that if I am not deceived in my own affair, the matter of the principal part of the Breaſt, and the whole Fabrick of the *Lungs* ſhall be made certain and evident, foraſmuch as all things do ſo aptly anſwer to one another, and are grounded upon Geometrical Principles. The ſum of it is this in the Authors own words.

Ruit in Aſperam Arteriam aer, momento compoſito ex gravitati & vi laterali, eaque Aeri, extrinſecus ſuperficiem pectoris circumprimenti, æquiponderat. Hinc muſculis Inſpiratoriis ſeſe contrahendi poteſtas permittitur; unde Coſtarum elevatio ac dilatatio, & aucta Pectoris amplitudo: Tum penitior Aeris irruptio, & expanſio ductuum pulmonarium; quod totum in Inſpiratione *contingit.*

Mox proprio pondere concidentibus ſupra tumidum Pulmonem coſtis, ſpatium Pectoris fit Anguſtius, & ipſarum ac diaphragmatis vi Pulmo comprimitur; Aerque partim per os extru-

ditur, partim ad minima uſque vaſcula adigitur, ſi quorum anguſtias penetrare proprio pondere non potuit; quouſque totus Pulmo detumeſcat, reſtitante ſolum in ejus veſiculis expanſa Aeris portione: quæ ſeries eſt Exſpirationis. *Hinc reſiſtentiæ minoris occurſu poteſt externus Aer rurſus irruere, eoque ordine, Reſpirationis opus peragere.*

Hæc autem ut evincantur, oſtendam prius, Muſculos pectoris non modò diſpoſitos ad leges Mechanicas, adeóque pro majori ſuperanda reſiſtentia validiores, pro minori debiliores, verùm etiam, quadam interioris Geometriæ peritiâ, ut ſeſe in Inſpiratione contrahentes, figuram Pectoris multò capaciorem efforment. Coſtas in Expiratione ex ſeipſis concidere, figuræ, poſitionis, atque articulationis beneficio: Diaphragmatis ac Muſculi Triangularis fabricam (quantum ex aliorum ſciam figuris ac ſcriptis, nulli cognitam) nec non utriuſque uſum perſimilem; Ex quibus ea omnia evidenter conſtabunt.

Inſuper, Unum *eſſe* Uſum *Aeris in Pulmonibus, ut ſcil. à Capillaribus Vaſis Arteriæ pulmonariæ ad Capillaria Venæ Sanguinem adigat, ſeu ex uno ſinu cordis in alterum; atque in hoc tranſitu per pulmones ſanguinem ſolvi.*

Neque ita in Homine ſolum, verum hæc eadem etiam in Brutis *ita ſe habere moſtrabimus; & machinam in* Avium *coſtis perelegantem exponemus; quid porrò Vicarium Coſtis in* Teſtudinibus: *Idemque obtineri per* Aquam, *à* Piſcibus *ad bronchias expulſam, quod à cœteris per Aerem, pulmones explicantem.*

Hinc verò, quanta & quam facilis Propoſitionum ſeries, ad Pulmonum omnium figuras, ſuctus, vulnera, reſpirationes varias, mutatas, aut impeditas, in Aeris, Pulmonum aut Pectoris ſtatu diverſo: Quæ omnia quivis intelligat ex ſeipſo, dummodo id etiam ſuppoſuerit, Aerem æquo rariorem, & æquo denſiorem, Reſpirationi eſſe ineptum, & ſanguinis per pulmones excurſum prohibere.

Denique, ex iiſdem principiis deducam, probabiliter Fœtum in Utero non reſpirare; quod fortè etiam Geometricè demonſtrabo, ſi Diametros Arteriæ pulmonaris & Anaſtomoſis cum Arteria Magna comparare licuerit.

Addam his Opuſculum de Motu atque Uſu Bilis, *quorum alterum Geometricum eſt, alterum ex eo pendens, Obſervationibus illuſtrandum.*

illuſtrandum. Evincet illud, Fel *à Jecore & Veſicula ad inteſtina fluere; non è converſo: nec à Veſicula & Jecore in Cavam, ſpectatâ momentorum diverſitate, qua moventur fluida per contractiles & inæqualis amplitudinis tubulos. Vnde conſtabit, Bilem è Veſicula elici non poſſe, niſi extrinſeca aliqua virtute comprimatur, quam ab adſtante & diſtento cibis Ventriculo petam; ſtatuens, Bilem in Veſicula ad digeſtionis tempus ſervari; ac tantum non evidenter oſtendens, per ipſam, tum temporis ad Duodenum fluentem, cibum à Ventriculo præparatum in Chylum faceſſere. Hinc ratio ſitûs Veſiculæ, Capſulæ communis in Jecore; cur item ductuum Felleorum aliquot in Veſicula deſinant; cur non-nulla Animalia eâdem deſtituta ſint, facile ex præcedentibus explicatur. Adhuc tamen obſervandus mihi ſitus Veſiculæ in quotquot occurrant Animalibus, præcipuè Carneo ventriculo præditis.* Pancreatis *etiam locum penſito, & humorem illius exprimi eodem, quo Bilis, tempore, deduco; ut ab utriſque permiſtis Chylus formetur.*

Erit hîc, Appendicis loco, Geometricum quiddam, demonſtrans, Quî fieri poſſit, ut in Veſica Vrinaria generentur Conchylia ſpiralia, ſi per Vreteres exprimatur quid molle aut viſcidum, in Veſicæ reſiſtentiam incidens, eaque occaſione explicabitur, quo pacto in ſuperficie Terræ ſimilia intorta corpora poſſint produci, qualia in quibuſdam montibus obſervavi.

So far this Inquiſitive Anatomiſt, which the Publiſher (who very much doubteth, whether any Copies of this intimation, Printed at *Piſa* this very year, beſides that one, which lately came to his hands, be to be found in *England*) thought fit to inſert in theſe Papers, thereby to adminiſter occaſion to our dextrous Anatomiſts here, with all poſſible diligence and care to purſue, joyntly with that *Italian* Profeſſour, thoſe important Inquiries about ſuch conſiderable Subjects, as have been above related; comparing with their Reſearches in this matter the many notable Experiments, lately publiſhed in No. 63. and 64. of theſe Tracts, made and communicated by the Honourable *Robert Boyle.*

A Narrative of a Monſtrous Birth in Plymouth, *Octob.* 22. 1670; *together with the Anatomical Obſervations, taken thereupon by* William Durſton *Doctor in Phyſick, and communicated to Dr.* Tim. Clerk.

ONE, *Grace Batter'd,* the wife of a ſhoemaker, of honeſt Repute, and mother of five Children, now come to the full time to be delivered of a ſixth Birth, about twelve a Clock at night began to have travelling pains; and near four a Clock in the morning the Head of a Child came to the Birth: When the Midwife, putting her hand to help off this, felt another, (by its heat and motion) alive; and therefore made all poſſible ſpeed to deliver her of this.

'Tis obſervable, that in three of her former five travels ſhe was ſo quick, as that ſhe was deliver'd before the Midwife came; but now ſhe could not ſo ſpeedily effect her deſire, in regard that not only the firſt child was ſuffocated by its ſtay in the birth; but alſo the Head of the ſecond turning aſide from the inner orifice of the *Uterus* towards the groine, and the Twins being joyn'd together (as afterwards appeared) made it a different Birth. But the Midwife doing her part exceeding well, and the Mother having nimble travel, was delivered of thoſe prodigious Twins, the *effigies* of which is here ſent you incloſed, (See *Table* 2. *Figure* 1.) together with an Accompt of what we thought further worth obſervation.

This Birth, as you ſee, had two Heads, and two Necks, as alſo the Eyes, Mouths, and Ears, ſutably double. Four Arms with Hands, and as many Leggs and Feet. There was to both but one Trunk; but two Back-bones, from the *Clavicles* to the *Hypogaſtrium*, and from the ſhoulders down to the bottom of the Loins they were not diſtinct, but cemented and concorporated, after this manner: The right *Clavicle* or Channel-bone of the Right-hand-Child (being long) joyned with the left *Clavicle* of the Left-hand-Child. The Ribbs on the face-ſide of both of them, by the Cartilages or Griſtles were united without any intervening *Sternum* or Breſt-bone;

and ſo made a common Cheſt to them both: And the Ribbs of both on the Back-part were united by the Griſtles; and from the Clavicle down to the *Hypogaſtrium* or bottom of the Belly there, were ſo conjoyned, that they made but one common Belly, with one Navel-ſtring to them both; but from the *Hypogaſtrium* downwards they were divided, and became two, each having the perfect parts of Females.

Having with ſome difficulty obtained the Fathers leave to diſſect it, we firſt weighed this Birth; the weight whereof was *eight* pounds and a *quarter*; the Circumference of the left head was about *eleven* Inches, that of the right being half an Inch leſs. The Circumference of the Trunk was about *Sixteen* Inches and a *quarter*; and the length of both, from head to foot, was full *eighteen* inches and *an half*.

We found one Navil-vein, and one Liver, but that was very large, with the Bladder of Gall ſeated in its uſual place: but there were two Urinary Bladders, two Wombs, four Kidneys, and one Stomach, with the *Oeſophagus* or Gullet perforate and open from the Mouth of the left head: but the *Oeſophagus* from the Mouth of the right head deſcended no lower, than a little above half an inch off the Mid-riff, and there it ended. No further could we follow it with the probe, but doubting a failure in that Experiment, we made an Eſſay with a Blow-pipe, and thereby we found, that the Wind would go no further than the place abovementioned. Whence it may be concluded, that the Right-handed Child muſt have received its nouriſhment by and from the Left Child.

There was but one *Colon* or Colick gut, which terminated into two *Inteſtina recta*. So there was but one Midriff, and above that, we could find little or no appearance of Lungs; but only a very large Heart, (with two Auricles,) the figure of which was not Conical, but like a Souldiers *pera* or Snapſack, or the Ventricle or Stomach; and lying near under the Clavicles, tranſverſe, as the Stomach lyeth under the Midriff and Liver. We did alſo obſerve two Ventricles with the tricuſpid or ſigmoid-valves; as alſo the *Vena Cava* and *Aorta* dependant, and alſo the *Aorta* aſcending and bifurcate towards each neck, and then bifurcate again.

Theſe Twins were exactly like one another; very well featured, having alſo pretty neat and handſome Limbs. They had their hair more than ordinarily thick, and about half an Inch long, and the nails full grown.

We might have proceeded to further Obſervations, but time and the tumultuous concourſe of people, as alſo the night, and likewiſe the Fathers importunity to haſten the Birth to the Grave, hindred us.

The Mother is at this time in as good a Condition of Health, as Women in Child-bed uſe to be.

Obſervations on Inſects, lodging themſelves in Old Willows, Produced before the Royal Society *by Dr.* Edmund King, *July* 14. 1670.

YOu may remember, that about the *beginning* of *May* laſt, a piece of old Willow-wood, being ſent me from Sir *John Bernhard* out of *Northamptonſhire*, was producec before you; in which were lodged many Inſects curiouſly wrapt up in green Leaves, in ſeveral channels or burrows, each with 12, 14. or 16. leaves round the Body, and ſeveral of them with as many little round bites of leaves at each end, to ſtop them up cloſe. Theſe, thus made up, are near an Inch long or the beſt part of an inch, put in one after another into a bore made in the wood, fit for their reception. They are in the manner of Cartrages of Powder, wherewith Piſtols are wont to be Charged, or like long ſlugs of lead, as are ſometimes uſed in ſome parts of thoſe burrows; they are placed ſo near one another as to touch; in others, at ſome conſiderable diſtance. Theſe Inſects obſerve this method in placing themſelves, that ſometimes they make a direct way into the length of the wood, ſometimes they bore out into the ſide, and run another way, thoſe Channels being not unlike the burrows of Rabbets; all which they fill up with theſe round appearances of wrapt leaves, all regularly wrought: In which I find either ſomething alive, or appearances of ſomething that hath dyed there, and is putrified: In ſome a great number of Mites, of a dark aſh-colour, ſhap'd not unlike common Mites; in others, I find ſeeming excrements of ſome ſmall Inſect, with the decayed parts of the dead Inſect; in others, white Maggots, which you ſaw. Some of theſe Maggots I took out of their *Theca* or bagg, and put them in warm places in the Sun; and they thereupon grew ſomething bigger, but changed not ſhape nor colour, but dyed. The reſt I kept cloſe in a box till the eighth of *July* preſent: then I took one of them out of the wood, and open'd the leaves, and felt ſomething ſtir, hearing alſo an humming noiſe like that of a Bee; and as ſoon as I had open'd the *Theca*, a perfect Bee did fly out againſt my window, as ſtrongly as a common Bee out of an Hive, having much of the colour and bigneſſe of thoſe when they are new Flyers. Then being pleaſed at the ſight, I took five more (all I had left) and put them in a Box into my Pocket, to ſhew them the Lord *Brouncker*, before they were taken out, or had eaten their way out; but his Lordſhip not being at home, I brought them back again; and they being diſturbed, they all eat themſelves out; and coming home, they were all creeping about my Box, and are ſince dead there, and are theſe, I here preſent to your View. They have all ſtings as other Bees have. I had ſome thoughts at firſt ſight, by the yellowiſh Circles under their Bellies, that they might be a ſort of Waſps; but now am of opinion, that they are common Bees.

Extracts of two Letters, written by Francis Willoughby *Eſquire, to the Publiſher, from* Aſtrop, *Auguſt 19th and from* Midleton, *Sept. 2d.* 1670 *Containing his Obſervations on the Inſects and Cartrages, deſcribed in the precedent Accompt.*

1. I had the good luck to find a great many of your Cartrages in a rotten Willow; and, by the ſhape of the Maggot, was moſt confident, they would produce Inſects of the Bee-tribe. And this I ſhould moſt certainly have foretold you, had I ever received thoſe you ſent me by Mr. *Le Hunt*: But having only that one, you ſent me before, I was ſo fond and choice of it, that I durſt not open it. I think now, I have found out the whole myſtery; and if you pleaſe to ſend me Dr. *Kings* account, and one of your Bees, I may perhaps add ſomething; and ſhall be glad to be inſtructed in any thing, that hath eſcaped me. I deſire one of the Bees, becauſe all mine being of a late Hatch, and none of them yet turned into *Nympha's* (which is the word of Art for the *Aurelia* of a Bee,) I fear, I ſhall not ſee their laſt *Metamorphoſis* this year. In a Garden, near a Willow, I found, where they got their leaves for their Cartrages; which are not Willow but Roſe-leaves. I will now proceed no further.

2. At my coming home I found the long expected Cartrages, and ſome of the Bees hatched; ſo that now we want nothing to compleat their Hiſtory. I will trouble you only with thoſe particulars, that I find not mentioned in Dr. *Kings* paper, to whom we owe the knowledge of their productions, and whoſe obſervations concerning them our own experience hath ſince confirmed. Mr. *Snell*, an Ingenious Gentleman, brought of them to the Wells at Aſtrop, who directing me to the place where he got them, I there found great plenty in the Trunk of a dead Willow.

Beginning to unfold ſome of them, Mr. *Wray* immediately judged them to be made up of pieces of Roſe-leaves, and called to mind, that this very Spring a worthy friend of his, Mr. *Francis Jeſſop*, brought him a Roſe-leaf, out of which himſelf ſaw a Bee bite ſuch a piece, and fly away with it in her mouth. Whereupon ſearching the Roſe-trees thereabout, we found a great many leaves, with ſuch pieces bitten out of them, as theſe Cartrages are made up of; ſome of which I ſent you incloſed in my laſt. The *Cuniculi* or holes never croſs the grain of the Wood, excepting where the Bee comes in, and where they open one into another. From the place of entrance, they are wrought both upwards and downwards; ſo that ſometimes the Bee-maggot lyes under her food, and ſometimes above it. One end of the Cartrage, *viz.* that which is next the entrance, is alwaies a little concave; the other end, which is furtheſt from the entrance, a little convex, and is received into the concave of the next beyond it. The ſides of the Cartrages are made up of oblong pieces of leaves, and paſted together; the ends, of round ones: And where ever they do not lye cloſe one to another, the intermediate ſpace is filled up with a multitude of theſe little round pieces, laid one upon another.

Theſe leaves were well delivered to the Publiſher.

The Cartrages contain a pap or batter, of the conſiſtence of a Gelly, or ſomething thicker; of a middle colour between Syrup of Violets and the Conſerve of red Roſes; of an acid taſte, and unpleaſant ſmell. In each of theſe, at the Concave end there lies one Bee-maggot, which feeds upon the forementioned matter, till it grows to its full bigneſs, and then makes, and encloſeth her ſelf in, a *Theca* or husk, of a dark-red colour, and ovall Figure; in which ſhe is changed into a Bee. The remainder of her food you may find dried into Powder at the Convex end; and her excrements at the Concave without the *Theca*.

The Bees, I found in your box (which are the only ones I have yet ſeen) were of a ſhorter and thicker ſhape, than the common Hony-bee, more hairy, &c. But the ſureſt mark to diſtinguiſh them, is, that the *forcipes* or teeth of theſe are bigger, broader, and ſtronger; in ſhape like thoſe of a Waſp or Hornet; from which ſhe alſo ſufficiently differs in having a tongue like a Bee, which *they* want.

They made their way out along the channel thorough all the intermediate cartrages, and not thorough the ſolid wood. Of the corruption of the matter within the Caſes, when the Bee-maggots or *Nymphæ* happen to miſcarry, are bred little *Hexapods*, which produce Beetles; too Maggots, which produce Flyes; three Mites, *&c.*

From what hath been obſerved concerning this Bee, and by a great many more parallel Inſtances, we may anſwer the *Quære* of ſome, that have written of Bees, whether it be the Old Bee, or the Bee-maggot, that covers the Cells before the Change? And ſay, that it is the Maggot, and not the Old one. For, here the Old Bee, when ſhe hath left proviſion enough, with an Egge cloſes up the Cartrage; and hath no more to do: The Maggot a great while after making the *theca*, which is analogous to the cover of the Cells.

In Table 2; Figure II. repreſents the Leaf, out of which a long piece, as Figure III. and a round piece, as Figure IV, were bitten. Figure V. ſhews the Cartrage it ſelf; and Figure VI. the *theca*.

A Confirmation of what was formerly Printed in Numb. 50. *of theſe Tracts, about the manner of Spiders projecting their Threds; communicated by Mr.* John Wray, *to the Publiſher.*

CОncerning the manner of Spiders projecting their threads, I received the following account from Dr. *Hulſe*, from whom (to do him right) I muſt acknowledge, I had the firſt notice of this particular, which was not long after communicated to me by another Ingenious Friend, whoſe Letter I formerly ſent you to be imparted to the *R. Society*. Nor is it any great wonder, that Inquiſitive perſons, applying themſelves to obſerve and conſider the ſame Subjects, ſhould make the ſame diſcoveries.

I have (*ſaith he*) ſeen them ſhoot their webbs three yards long before they begin to ſayl; and then they will (as it were) fly away incredibly ſwift. Which *Phænomenon* doth ſomewhat puzle me, ſeeing oftentimes the Air doth not move a quarter ſo faſt as they ſeem to fly. Moſtly they project their threads ſingle, without dividing or forking at all to be ſeen in them: Sometimes they will ſhoot the thread upward, and will mount up with it in a line almoſt perpendicular; and at other times, they project it in a line parallel to the plain of the Horizon; as you may often ſee by their threads that run from one tree to another, and likewiſe in Chambers from one wall to another. I confeſs, this Obſervation at firſt made me think, that they could fly, becauſe I could not conceive, how a thread could be drawn ſo parallel to the Horizon between two Walls or Trees, as above-ſaid, unleſs the Spider flew through the Air in a ſtraight line. The way of forking their threads is expreſſed by the following Figure. (See *Tab. 2. Fig.* VII.) What reaſon ſhould be given of this dividing, I know not, except that their threads being thus winged, become better able to ſuſtain them in the Air.

They will often faſten their threads in ſeveral places to the things, they creep upon: The manner is, by beating their tayles againſt them as they creep along; which may be underſtood by this line. See *Tab.2.Fig.*VIII. By this frequent beating in of their thread among the aſperities of the place, where they creep, they either ſecure it againſt the wind, that it be not eaſily blown away; or elſe, whilſt they hang by it, if one ſtick breaks, another holds faſt; ſo that they do not fall to the ground.

A Note Concerning the next foregoing Relation.

After we had received the precedent Confirmation touching the *firſt* obſerver of the *Darting of Spiders*, there came to hand a Letter from that Inquiſitive Gentleman, Mr. *Martin Liſter*, intimating, That if we were not yet fully ſatisfied about that matter, he had this further to ſay; that Mr. *Wray* knew nothing of his knowing it, no more than he (Mr. *Liſter*) knew, that either he or any body elſe knew it, untill ſuch time, as he occaſionally ſent him a Catalogue of our Engliſh Spiders: Upon which ſubject, in the next Letter, Mr. *Wray* put this among other queſtions to Mr. *Liſter*, whether he had obſerved the Darting of Spiders: To which he anſwer'd in the affirmative, relating to him many other circumſtances not obſerved by him before, ſo that he was deſired by M. *Wray*, to draw up his notes, and ſuffer him to preſent them to the *R. Society*: which he did. After which, the ſaid Notes were alſo publiſh'd, in *Numb.* 50. of theſe Books.

Whence it appears, that this Obſervation is as well Mr. *Liſters*, as Dr. *Hulſe's* (as is alſo acknowledged in the beginning of the precedent Account;) though it be true alſo, that when it was written and ſent by the former of thoſe two Gentlemen, it was not then a thing altogether unknown to Mr. *Wray*, but confirmed and enlarged by Mr. *Liſters* own

Obſervations. Which was thought fit to add here, that nothing might be detracted from Mr. *Liſter* for permitting his Notes in the lately mention'd Tract to be publiſhed as his own, which really they are.

An Accompt of ſome Books.

I. *DE CORPORUM AFFECTIONIBUS cum MANIFESTIS tum OCCULTIS, Libri Duo : Seu Promotæ per Experimenta Philoſophiæ Specimen. Auth.* J. B. Du Hamel, *Eccleſiæ Bajocenſis Cancellario.* Pariſiis, 1670. *in* 12°.

THe Learned Author of this Treatiſe having repreſented in the *Preface*, that the *Grecian* Philoſophy concerning Nature, hath been ſo far from being able to grow up any thing conſiderably, that by the more Generous and the more Intelligent men of this Age, it is eſteem'd rather to have degenerated and decayed ; giveth here a *Specimen* of Natural Philoſophy improved and advanced by Obſervations and Experiments ; not only endeavouring to explicate, from the Principles of the Modern Philoſophers, the Qualities and Powers of Bodies, but alſo giving an Accompt of the more notable Experiments, made in this Age in divers places, as *England*, *France*, *Italy*, *Germany*, *&c.* In the Performance of which he treats,

In his *Firſt* Book, of the Origine and Nature of Qualities in General ; then, of Heat and Cold ; of Fluidity and Firmneſs and other Tactile Qualities ; of Taſts, Smells, Sounds, Light, and Colours. In the *Second*, Of Medicaments in General ; then, of the Vertue and Uſe of Preparing, Alterative, Purgative, and Topical Medicines ; as alſo of Poyſons and Antidotes. In the ſame, he proceeds to conſider Magnetiſme, Electricity, Gravity in general, and the Accelerated motion of Heavy Bodies : Concluding the whole with the conſideration of Librated Liquors, and the Weight of the Air.

All which is deliver'd not only with a ſingular brevity and plaineſs, but alſo with that ingenuity, that the Author every where candidly acknowledgeth, to whom he is chiefly obliged in theſe Eſſayes, alledging among the *Engliſh* Philoſophers moſt frequently and very honourably, the Noble *Robert Boyle*, and not forgetting the Illuſtrious *Bacon* and *Digby*, the Learned *Gilbert*, *Harvey*, *Gliſſon*, *Goddard*, *Merret*, *Willis*, *Hook*. Among the *French*; the famous *Gaſſendi*, *Des-Cartes*, *Paſcal*, *Fabry*, *Magnan*, *Du Clos*, *Morin*, *Petit*, *Cordemoy*: Among the *Italians*; the Excellent *Galilæo*, *Torricelli*, *Cabæus*, *Zucchius*, *Riccius*: Among the *Dutch*; the Curious *Otho de Geriok*, *Grimaldus*, *Bontius*, *Piſo*, *Walæus*, *Sylvius*, *Tachenius*, *Voſſius*: And among the *Danes*, the Learned *Eraſmus Bartolin*.

In the mentioning of which candour in our Author, we muſt yet take notice of one particular, alledged by the ſame, relating to that Honourable perſon, whoſe Writings he ſo often maketh uſe of (I mean Mr. *Boyle*:) Which is, That, when Mr. *Du Hamel* declareth p. 57. his diſſent from *him* in the Explication of the manner, how the World once framed, and the Courſe of Nature once eſtabliſhed, are preſerved, he underſtands him, who diſcourſes thereof in his Treatiſe of the *Origine of Forms and Qualities* p. 104. as if he excluded from the Generation and Growth of Living Creatures, the Creators *New* Concourſe; and eſteems, that to the admirable ſtructure of Animals, and the wonderfull variety, uſe and diſtinction of their Organs, there is more required, than can be accounted for by the Common Laws of motion. In anſwer to which, we deſire, it may be obſerved, that as M. *Du Hamel* declareth not for the neceſſity of a *particular* Concourſe of the Creator in the Phœnomena inſiſted on by him, ſo that judicious writer, whom he reflects upon, will not be found to deny that new Concourſe, pleaded for by *Du Hamel*; but rather, by aſſerting the *continued* general and ordinary ſupport and influence of the Firſt Cauſe implyeth that that preſervation and concourſe ever and conſtantly perpetuated is *ever new*, and conſequently keeps things in their priſtine ſtate and vigour, at leaſt ſo far, as the Creator did once determine they ſhould be kept. In ſhort, the Great Architect and Superintendent of the Univerſe, having once by a ſignal guidance contrived the Univerſal matter into the World, and particularly ſome portions of it into ſeminal Organs, and Principles, and ſetled the Laws, according to which the motions and actions of its parts upon one another ſhould be regulated, he doth now by his un-interrupted influence, preſerve the Powers and Operations of thoſe Principles or Springs by which they were by him once ſet a going.

II. *ELEMENTA PHYSICA, ſive Nova Philoſophiæ Principia; ubi Carteſianorum Principiorum falſitas oſtenditur, ipſiuſque errores ac paralogiſmi ad oculum demonſtrantur ac refutantur*, *à* Franciſco Wilhelmo *Libero Barone de* Nuland, *&c. Hagæ Comitis*, 1669. *in* 12°.

THough the Author of this ſmall Treatiſe, which came to our view by a particular friend, (our Stationers having as yet procured no Exemplars of it) lays down an *Hypotheſis* of Natural Philoſophy; yet will he not be underſtood to be *reſolved* to adhere unchangeably to it; but rather judges it more uſeful to employ great care and much time in obſerving the Effects of Nature; highly commending, for that method, the two lately founded Philoſophical Academies in *England* and *France*, which by Obſervations and Experiments, faithfully made, labour to attain the knowledge of Truth.

Concerning M *Des-Cartes*, though our Author declareth a high eſteem of his Ingenioſity, yet is he of opinion, that the fondneſs, which that great man had for his Syſteme of the World, and for the admirable Symmetry and congruity found therein, did ſo blind him, that he could not ſee his Errors in its contrivance. For, ſaith he, if he had but more attentively conſidered (for example) the nature of *Circular Motion*, he would never have found any *conatus* or endeavour in Bodies circularly moved to recede from the Center, but ſeen that that motion differed in nothing from another motion;(which he pretends to have demonſtrated,) and conſequently would not have ſuperſtructed ſo many things upon that endeavour, which, upon the overthrow of the foundation, muſt fall of themſelves.

To the Book is prefixed an Extract of a Letter of M. *Hugens*, declaring *firſt*, that the Diſpute touching the *Idea's*, and the proof of the Exiſtence of God by the way of *Des-Cartes*, is very obſcure. *Secondly*, that he (Monſieur *Hugens*) is of the opinion of this Author, in that he allows not *Solidity* or *Hardneſs* to be ſeparable from the nature of Body; which is repugnant to *Des-Cartes*, who maketh a Body to conſiſt only in *Extenſion*. And *Thirdly*, that in what *Des-Cartes* hath written of Motion, 'tis certain he did ſomewhat force himſelf, to avoid the condemnation of his Philoſophy at *Rome*, for having ſuppoſed the Earth to move.

In the Book it ſelf, is obſerved this Method: *Firſt*, the Author declareth, how of nothing all the Matter of the Univerſe hath been made and condenſed; ſhewing withall the nature and properties of Matter, and wherein it differs from Space or a *Vacuum*, and making it his buſineſs to reſtore to Philoſophy that *Vacuum*, which he judgeth to have been ungroundedly proſcribed by *Des-Cartes*, and which together with *Matter* is eſteemed by him to conſtitute all the diverſity and variety of Bodies in the whole Univerſe. *Next*, he teacheth, that the Form of the Univerſe conſiſts in its *Figure*, ſhewing, How of one and the ſame matter ſo many different things could be produced. *Then* he evinceth the Efficient Cauſe of the World to be a moſt Potent and Eternal Being, but by a proof different from that of *Des-Cartes*; and maketh it out, that that Being hath produced all the Bodies that are in the World by no other inſtrument, but Motion; whoſe Nature therefore and Laws he inveſtigateth, *viz.*

1. Two Equal Bodies, moved with *equal* celerity, if they meet one another, will reflect, without looſing any thing of their celerity.

2. Two Equal Bodies, moved with *unequal* celerity, if they meet one another, that which moveth more ſlowly, can give nothing of its celerity to the other.

3. Neither can that, which moveth with greater celerity, communicate its whole motion to the other.

4. If two Equal Bodies, moved with *unequal* celerity, meet one another, they will reflect; and the motion which the Body, that moveth more ſwiftly, communicateth to the leſs ſwift, ſhall be to its whole motion, as celerity is to celerity.

5. If there be two Equal Bodies, whereof the one moveth infinitely ſwifter; after their mutual encounter, that which moved more ſwiftly, ſhall be quieſcent, by communicating all its motion to the other.

6. If two Bodies be *unequal*, and the leſſer do move in that proportion, wherein the other exceeds it in bigneſs, they ſhall reflect after the encounter, ſo as to looſe no degree of celerity.

7. If two Bodies be to one another in any Proportion given, but the leſſer move infinitely ſwifter; if the other be quieſcent, it ſhall impell it, how big ſoever it be.

8. If there be a proportion of Equality, the moved Body will be quieſcent by communicating its whole motion to the other.

9. But if that which is moved, be leſſer, it will be reflected looſing a part of its celerity, which it will impart to the other.

10. But if it be greater, it will move the ſame way, looſing alſo a part of its celerity, which the other will receive.

III. *A Diſcourſe of LOCAL MOTION, Engliſht out of* French. *London*, 1670. *in* 12°.

THis Diſcourſe undertaketh to demonſtrate the *Laws* of *Motion*, and withall to prove, that of the *Seven Rules* deliver'd by *Des-Cartes* on this Subject, he hath miſtaken *ſix*. In the doing of which, the Author particularly inſiſts on, conſidering the communication of Motion in *Percuſſions*; declaring, that, though this Subject hath been handled by very Eminent men, yet he taketh it otherwiſe in hand than they have done; foraſmuch as without making any particular *Hypotheſis*, he maketh it his buſineſs to ſearch into the very Scurces of Nature, the Cauſes of all the Effects we find in Motions; and undertakes to give the demonſtrations of them. He is not ignorant of what hath been lately publiſh't by ſome famous Mathematicians of the Royal Academies of *London* and *Paris*. Neither doth he conteſt with thoſe perſons about that, which they pretend to, of having found the ſecret of the *Laws* of *Motion*. He only ſaith, that 'tis now three years that he gave abroad what he delivers in this Diſcourſe; and that, his Rules being compared with theirs, there may poſſibly be found conformity enough to make men believe, that he hath lighted together with them upon the truth, but that yet there will alſo be found difference enough, to make men judge, that he hath not learnt it from them. Beſides (*ſaith he*) they have done no more than meerly propoſed their Rules without proving them; whereas he undertaketh to *demonſtrate* all thoſe, he advanceth: Adding, that though M. *Hugens* hath given us hopes of publiſhing ſhortly a Book, wherein he will prove all his Rules, yet he dares affirm, that the *Hugenian* Method will be quite different from his, foraſmuch as he (M. *Hugens*) hath already explained himſelf ſufficiently, to give us to underſtand, that his demonſtrations are grounded upon particular *Hypotheſes*.

The chief Heads, explained in this Diſcourſe, are, That

1. A Body is in it ſelf indifferent to Reſt or Motion.
2. If a Body be once at Reſt, it will ever remain therein.
3. And if it be once in Motion, it continues to move alwayes.
4. That *Reſt* is not a meer Negation; and that there is as much Poſitive Action in Reſt, as in Motion.
5. The Bodies which we move, do ceaſe to move becauſe they are impeded.
6. A Body ſucceſſively receiving many Determinations, remains only affected with the laſt.
7. A free Body cannot be determin'd to move in a *Curve* line, nor with unequal celerity.
8. Every Body that moveth about a Center, endeavors to recede from it.
9. How a Body may be moved Circularly.
10. One Body moving againſt another Body gives it its whole Motion.
11. In the meeting of two Bodies there is made a Percuſſion which is mutual, and equally received in both.
12. A moving Body, meeting another Body that is Quieſcent, gives it all its Motion, and remains it ſelf moveleſs.
13. What is meant by *Abſolute* and *Reſpective* Velocity.
14. The Percuſſions are as the reſpective Velocities.
15. Two Bodies meeting one another, turn back, making an exchange of their Velocity.
16. Two Bodies moving toward the ſame places, continue after their encounter by exchanging their Velocities.
17. An hard Body coming to hit another Body that cannot be ſhaken, is reflected with its whole Motion.
18. The Angle of Reflection is equal to the Angle of Incidence.
19. It may be imagin'd, that the Oblique motion is compos'd of two Motions.
20. A general Rule of all Percuſſions.
21. There is alwaies equal quantity of *reſpective* motion.
22. The midſt of two Bodies is alwaies uniformly mov'd in a direct line.

23. All theſe Rules are true, whether the bodies be equal or unequal.

24. A body moveth in *pleno* as freely as in *vacuo.*

25. The Percuſſions of *equal* bodies are made in *pleno* as in *vacuo.* But when the bodies are *unequal*, the Percuſſions are made in *pleno* otherwiſe than in *vacuo.*

26. The Percuſſions of unequal bodies cannot be reduced to one General Rule.

27. Of Refraction.

28 An Appendix containing a Review of this Diſcourſe.

IV. *Congietture Phyſico-Aſtronomiche della Natura del Univerſo, da* Pietro *M.* Cavina; *in Faenza*, 1669. *in* 4.

THeſe Conjectures are raiſed by the Author upon ſome Celeſtial obſervations about the *Fixed* Stars at *Faenza.* The whole Tract conſiſts of three parts; Conſiderations, Obſervations, and Reflections.

In the *firſt*, this Writer taketh notice, 1. That men for many Ages have ſo much doted upon *Ariſtotle*, as to deny Faith to Senſe, and Proof to Experience. 2. That one of the received, and much contended for, *Ariſtotelian* opinions is that of the *Ingenerability* and *Incorruptibility* of the Celeſtial Bodies; but that Heaven it ſelf, impatient, as 'twere, to be ſo little known, hath generated *New* Stars, brighter than the known ones; thereby to ſtrike the eyes of men, that are curious and diligent in the inveſtigation of truths. And hence he proceeds to the

Second part, containing the *Obſervations* themſelves; whereby he affirms to have found conſiderable changes in divers of the *Fixed* Stars from what *Bayerus* and others have remarked of them, as to Magnitude and Number; inſtancing in *Urſa* both *Minor* and *Major*, in the *Dragon*, *Ceſens*, *Bootes*, *Corona Septentrionalis*, *Hercules*, *Lyra*, *Cygnus*, *Caſſiopea*, *Perſeus*, and the *Via Lactea.*

Whereupon in the *third* part, having premiſed his method of obſerving and Meaſuring, he maketh theſe *Reflections*;

viz. 1. That the Stars of the *Firſt Magnitude*, their apparent Diameter being ſuppoſed to be 18″, and the Diameter of the Annual Orbe in the *Copernican* Hypotheſis being aſſerted, are at leaſt 71677713000 bigger than the Earth; and thoſe of the *Sixth Magnitude*, ſuppoſing their apparent Diameter to be 4″. 24‴, are 4378454048 times bigger, if *Ricciolo* have calculated aright in *Almag.* l.7 p.717. 2. That in the doctrine of the Earths Reſt, the Diſtance of the Fixt Stars is 100000 Semidiam. of the Earth; and, according to the *Copernican* Syſteme, 47439800 ſuch Semidiameters. 3. That, according to *Copernicus*, a ſtar of the *Second* magnitude cannot become of the *Firſt*, but it muſt grow 2562569939 bigger than the Earth, or approach nearer to the Earth by 1263841 Semidiameters of the Earth. 4. That in that part of Heaven, where one Star is grown bigger; another, not far off, is grown leſs, and *vice verſâ*; ſo that, if thoſe augmentations and diminutions could be exactly calculated, the ſums would be found equal.

From all which, the Author deduceth theſe Conjectures. 1. That the Heaven of the Fixt Stars is liquid 2. That it is Generable and Corruptible. 3. That the motion of the Earth is ſtill more improbable. 4. That theſe Variations of the Fixt Stars are Effects of the Sun; and that they are but moderately diſtant from the Sun. 5. That thoſe Stars are of a matter eaſily diſſipable; and like unto Lamps, which for want of aliment are extinguiſht, and by an acceſſion of aliment are magnified. 6. That all the Fixt Stars are in the Concave ſuperficies of their Heaven. 7. That both the Annual and Diurnal Motion of the Earth have no place, according to theſe Obſervations.

V. *Dimoſtratione Fiſico-Matematica delle ſette Propoſitioni, che promeſſe* Donato Roſetti. *In Firenze* 1668. *in* 4°.

These ſeven Propoſitions, which this Author pretends to have here demonſtrated, are theſe;

1. *What is the true Phyſical Cauſe of Equilibriums?*

2. *The Doctrine of* Archimedes, *importing, That a Floating body ſinks beneath the Level of the water ſo far, as that a maſs of water, equal to the part immerſed, doth abſolutely weigh as much as the whole floating Body; is falſe.*

3. *Tis very probable, that there is no Æther, and that conſequently there is a vaſt* Vacuum.

4. *There is a very eaſy, ſhort, and infallible way, exactly to know how much is the abſolute weight of the Air, that is impendent over any particular place.*

5. *With little leſs eaſineſs and brevity, but with the ſame infallibility may be weighed any one part of the ſaid Air; for example, a Cubical foot.*

6. *The only way of meaſuring the height of the Atmoſphere.*

7. *How it may be experimented, whether* Light *at the diſtance of* 40 *or more miles be moved in any obſervable Time?*

Theſe Propoſitions have occaſioned very warm diſputes in *Italy*, where they were firſt ſtated; as may appear by what hath been publiſht againſt this Author by Signior *Montanari* and Signior *Finetti*, to which we muſt refer the *Reader*. We ſhall only take notice here, that the ſecond of theſe *Propoſitions* ſounding harſh, our Author, ſomewhat to mollify it, alledgeth, That he intends not at all to oppoſe the Doctrine of *Archimedes*, much leſs that of *Galileo*, concerning *Floating Bodies*; but that he would conſider every body equilibrated, and how far every thing retains its *Moment* in this Univerſe, (where we find the whole to gravitate,) in order to examine the *Torricellian* Experiment; which is to ſerve him for the main ground to weigh the Air, and to meaſure the Atmoſphere: In which caſe (*ſaith he*) the Floating Body, if it did abſolutely weigh as much, as the maſs of water, equal to its part immerſed, it would not make the Equal Sectors of that Sphere, which the Equilibrated Fluids do conſtitute, Equal in Moment.

ERRATA.

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PHILOSOPHICAL TRANSACTIONS.

Decemb. 12. 1670.

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Extracts of two Letters, written by the Ingenious Mr. Adam Martindale *to the Publiſher from* Rotherton *in* Cheſhire, *Novemb.* 12. *and Nov.* 26. 1670. *concerning the Diſcovery of a* Rock of Natural Salt *in that Country.*

A Gentleman of good account and reputation aſſures me, that in our County there is lately found out a great rarity, *viz.* a *Rock of Natural Salt*, from which iſſues a vigorous ſharp Brine, beyond any of the Springs made uſe of in our Salt-works; and this not nigh any River or great brook, as all our Salt-ſprings in this Country are. I ſhould ſcarce have adventur'd to write this to you, had I not believed, that this diſcovery might perhaps prove uſefull towards the filling up of ſome blank corner of a Page in the *Hiſtory* of *Nature.* However I am perſwaded, that ſuch Ingenuity, as poſſeſſeth the *R. Society*, cannot but pardon my boldneſs, ariſing from a zeal to ſerve ſuch Benefactors to Humane nature. And if you deſire to know any more particulars concerning this matter, a Letter of yours directed * * * ſhall command me to view the place, and there to inquire after the circumſtances, and communicate them to you, &c.

This being ſo acceptable an offer, the Author of the Letter was deſired accordingly, to give himſelf the trouble of viewing the place himſelf: Which deſire he not only hath very obligingly complied with, but alſo imparted what he learned in that view, as follows;

I am juſt now return'd from viſiting and viewing the Salt-work, and find things according to my Friends Relation: Only whereas I underſtood him, that no running water came near it, I now perceive, that he ſpoke of none that was conſiderable, or none that might annoy it. For there runs near it (at leaſt in the Winter ſeaſon) a ſmall rindle (or gutter rather;) but it is wholly free from all danger of overflowing; which threatens all other Salt-pits in this County, every great ſhower, through the vicinity of Rivers.

The Rock of Salt, by the relation of the Work-men, is between 33, and 34. yards diſtant from the Surface of the Earth; about 30 whereof are already digged; and they hope to be at the Flagg, which covers the Salt-rock, about three weeks hence. I doubt, it will be ſeveral months, before I can accommodate you with a parcel of it; that which the auger brought up, being long ſince diſpoſed of, and the work-men not daring to remove the Flagg, till the Frame be finiſh't and well ſetled for the ſecuring of the work from the circumjacent earth. The Overſeer hath promiſed to furniſh me with a piece of the Rock for your uſe; as alſo to ſignifie to me the time, when they intend to uncover it; that, if poſſible, we may make ſome ſuch Experiments, as you have intimated. That parcel of Natural Salt, which the inſtrument brought up, divers that ſaw it aſſure me, was as hard as *Allom*, and as pure; and when pulverized, became an Excellent, fine and ſharp Salt. The firſt diſcoverer of it was one *John Jackſon* of *Halton*, about *Lady-day* laſt, as he was ſearching for Coals on the behalf of the Lord of the Soil, *William Marbury* of *Marbury* Eſquire. This is all I can at preſent ſerve you in; only I am conſulting diligent and experienced perſons concerning the practiſe of the Agriculture of this Country, and hope ere long to give you ſuch an account as I can; though I cannot hope to diſcover any thing worth the notice of that truly *Royal Society*. It will be enough to ſatisfie my ambition, if I may but be continued in your thoughts as a Well-wiſher to ſuch Noble perſons and deſigns. In confidence whereof I ſubſcribe, &c.

An Accompt given by a Florentin Patrician, call'd Jo. Batiſta Donius, *concerning a way of reſtoring the Salubrity of the Country about* Rome: *Extracted out of the ninth* Italian Giornale de Letterati; *and Engliſh't as follows.*

THe Campagne of *Rome*, (which is that Tract of Land, that is deſtitute of Inhabitants and Trees, and extends it ſelf for many miles, taking in *Latium*, and part of the antient *Sabins*, and of *Tuſcany*,) would be of great uſe to the State, and of ſubſiſtence to the people, if it could be Inhabited without that great danger to health, which now 'tis ſo much noted and fear'd for; Phyſitians eſteeming, that from the Summer-Solſtice unto the Autumnal Equinox, the Air of it is ſo bad and noxious, that it would be great raſhneſs to dwell there: A malignity, which in former Ages it was free from, at leaſt, in that of *Cicero*, who, as appears by his Letters

lived

lived there in the Summer-months, went from one place to another, and return'd to *Rome*, without making mention of any ſuch danger. Wherefore that Country not being unwholeſome of its own Nature, but from adventitious cauſes, it is probable, that thoſe may be remov'd; as hath been propoſed by *Jo. Battiſta Donius*, in his Book *De Reſtituenda Salubritate Agri Romani.*

This Author having in the beginning deliver'd ſome Conſiderations touching the Air of *Rome*, and ſhew'd, that it never was, nor is, inſalubrious, as 'tis thought; proceeds to that of the Country *about* Rome, and

Firſt, deſcribes both the Antient and Preſent ſtate and diſpoſition of the Roman Campagne; noting the ſituation of many antient places; ſeveral particulars about the Greatneſs and Compaſs of the City of *Rome*, and the Number of its Inhabitants. *Juſtus Lipſius*, out of his great partiality to Old Rome, believed, there were in it four Millions of men; but this Author thinks it much, if there was ſo much as one Million.

Secondly, he examines the cauſes, which render this Roman Territory ſo unhealthfull; aſſigning them to be the Southern Winds reigning there; the many ſtanding Waters; the lowneſs of the ſhore; the inconſtancy of the Weather; and the exceſſive heat of the Summer.

Thirdly, he diſcourſes of the Remedies; eſteeming that, as the inſalubrity of that Campagne began only after it was waſted and diſpeopled, by the incurſions of thoſe Barbarous Nations, that invaded *Italy*, and deſtroyed the habitations that were there; ſo the Air would recover its former good temperature, if that Country were again Inhabited, and tilled as before. So that, *ſaith he*, thoſe Fields have no other noxiouſneſs from Nature, but the exceſs of heat and moiſture, and a ſudden change of Winds; things, which indeed are apt to incommode, but not to make extraordinarily ſick, much leſs kill the Inhabitants. And then, as to the evils that have been occaſion'd by mens negligence, he thinks it an eaſie thing to remove them; ſuch as are many ſtagnant waters, which he judgeth may be eaſily drained away into the neighbouring Rivers by means of Channels, neglected hitherto.

The greateſt evil are the *Pontin* Lakes, and all that flat ſhore of the Sea, whence the Sun extracts ſtore of noxious ſteams, which infect the Air, being diffuſed by the Southern winds through the neighbouring Country, eſpecially by the South-Eaſt-Winds, which traverſing the length of thoſe Lakes, raiſe and carry away with them peſtiferous vapors. This Evil the Author would remedy by draining thoſe grounds, and by letting into them running and live waters; as alſo by planting woods of Pine-trees, that ſhould cover that Campagne and Rome it ſelf from thoſe pernicious Lakes.

Which being done, he would have the Houſes for the new Inhabitants built on raiſed ground, cloſe joyned together in the forme of Caſtles, there being no better remedy againſt an ill Air than that of many Fires kept cloſe together. And here he adviſes, that the Churches, Granaries and Ammunition-houſes, and other high Buildings ſhould be raiſed toward the South, thereby to ſhelter ſuch Caſtles from the Winds that blow from that quarter. But above all things he recommends, that good and wholeſome Waters may be conveighed thither; a thing little leſs neceſſary for life than Air it ſelf: On which occaſion he giveth an accurate account of all the Fountains, Rivers, and other freſh Waters, that are to be found in that Campagne.

Having ſaid this, he declareth ſo great a confidence of his in theſe means well managed, that he is perſwaded, the Inhabitants would ſoon prove very numerous there, eſpecially if men were by the chief Governours of *Rome* encouraged with the conceſſion of great priviledges and with good uſage to ſettle in that place.

An

An Experiment Concerning the Progreſs *of* Artificial Conglaciation, *and the remarkable Accidents, therein obſerved by the* Florentin *Philoſophers, and publiſh't in their* Saggi di Naturali Eſperienze p. 147; *now Engliſh't for the further Tryal and Obſervation of the Curious here.*

THe firſt Veſſel, we uſed (*ſay thoſe Eminent Academiſts*) for this Experiment, was a Globe of Chryſtal, whoſe Diameter was $\frac{1}{8}$ of a *braccio**, with a long ſtreight neck of about a *braccio* and an half, graduated into ſmall parts. Having fill'd it with common water, up to the ſixth part of the neck, we put the Globular part into Ice and Salt, after the uſual manner of artificial Freezing of Liquors, and began very attentively to obſerve all the motions of the water, from its level. It was ſufficiently known before, that Freezing worketh in all Liquors a contraction; as alſo, that in the paſſage, which the water maketh from being ſimply cold to the leaving of its fluidity, and taking a conſiſtency and hardneſs by congelation, it not only returns to the bulk, it had before it was frozen, but ſwells to a bigger; ſince we ſee, that veſſels not only of glaſs but of mettal are forcibly broken thereby. But what might be the limits and period of theſe various alterations, which the Cold works therein, we as yet did not know; nor is it poſſible to attain that knowledge in opacous veſſels. We therefore, that we might not want that inſight, which appear'd to be the Soul of all theſe Experiments, had recourſe to Chryſtal and Glaſs, hoping that by the tranſparency of that body we ſhould be informed of the whole progreſs; in regard that at every motion, which ſhould appear in the water of the neck, we might quickly take the Globe out of the Ice, and therein obſerve the alterations correſpondent thereto. But the truth is, that we took more pains, than we can expreſs, before we could find out any thing certain touching the periods of theſe accidents.

**Which is near three Engliſh Inches.*

And to deliver more diſtinctly the ſucceſs, you are to know, that in the firſt immerſion of the Globe, as ſoon as it touched the Icy water, there was obſerved in the water of the Glaſſes-neck a ſmall riſing, but that ſufficiently quick; after which, with a motion regular enough, and of middle velocity, it retired back to the Globe, till being come to a certain mark, it continued not to deſcend any further, but ſtopp'd there for a while, being altogether, as far as we could ſee, moveleſs. Afterwards, little by little it was ſeen to begin to riſe again, but with a very ſlow motion, which was in appearance even and regular; from whence, without any proportioned acceleration, it ſuddenly and furiouſly ſtarted upwards; in which time it was impoſſible to follow it with our eyes, it running up with this impetuouſneſs, in an inſtant, as 'twere, through ſeveral tens of the marked degrees. And as this violence began in a moment, ſo in a moment it ended; foraſmuch as from this very great velocity it ſuddenly paſſed to another degree of motion, which though nimble enough, was yet incomparably leſs than the precedent; and going on to riſe in this degree, it went to the top of the next, and at laſt run over.

All the while, that theſe things happen'd, there were at times ſeen on the top of the water ſome bubbles, either Aereal, or of another more ſubtile matter, now in a greater, then in a leſſer plenty: And this ſeparation did not begin till the water had begun to take a briſk cold; as if the force of ſuch a cold had the power of ſtraining ſuch matter, and ſevering it from the water.

Now being deſirous to ſee, whether thoſe alterations kept among themſelves any kind of Analogy, we began to reiterate the conglaciations, and no ſooner was one Ice deſtroyed, but we ſet it to freeze anew: And the water went to congele again in the ſame order of alterations; which yet did not every time return to the ſelf ſame points or degrees in the neck: Which made us believe, that they had no conſtant and ſtable period, as reaſon ſeemed to perſwade us they had. Mean time it fell out in repeating theſe Experiments, that having once unawares let the water of the Globe freeze near to the neck, the Globe burſt: Whereupon another being taken of a leſs ſize, to the end that the Cold might more ſpeedily and more eaſily get into all the water, and the neck of it being two *braccia's* long, that it might not run out; it was filled with water out to the 160th degree, and then put into the Ice. Here obſerving it with the beſt attention we could, we found *firſt*, that all the accidents of ſubſiding, riſing, reſting, ſtarting upwards, running, retarding, did alwayes follow in the ſame points of the neck of the Globe, that is, when the ſurface of the water ſtood at the ſame degrees; provided, that in the act of ſetting it in the Ice, care were taken, to put it to the very ſame degree, where it was, when put into the Ice the time before, that is to ſay, to the ſame temper of heat and cold: In which caſe the whole veſſel might be conſider'd as a very nice Thermometer, by reaſon of the great capacity of the Globe, and the exceeding ſtreightneſs of the Neck. This being provided for, we began to take notice of the preciſe time of Congelation; which to find aright, we did after every little ſpace of time take up the Globe out of the Ice; but how frequently ſoever we made ſuch obſervations, we never could ſo hit it, as to ſee even the leaſt veine of froſt, but alwayes it was either all fluid, or all frozen. Whence we conjectured, that the work of Congelation was done in a very ſhort time, and that he, who ſhould with taking pains have the luck to take the Globe out of the Ice in that nick of time, when the water ſhould receive that ſo ſudden change, would certainly find ſome thing very notable thereby. And becauſe by the ſo often taking out and putting the Globe into the Ice, the whole period of its changes was diſordered; we let it return to juſt the ſame mark as it was at firſt, and then placing it into the Ice, we fixed it to that degree, in which it was wont to take that very impetuous motion, and half a degree before it arrived thereto, we took it out. Then looking conſtantly with a carefull eye upon the water in the Globe, which by reaſon of the tranſparency of the Chryſtal was plainly ſeen to be yet altogether fluid and clear, the water, though now out of the Ice, did by the operation of the introduced cold, (after it had attained to its due point with a ſwiftneſs imperceptible to the Eye, the tranſparency within the Globular part being loſt, and it ſelf in an inſtant, as 'twere, deprived of its motion) totally conglaciate. Which Experiment we tried over and over again, and found it alwayes ſucceed alike.

An Extract of a Letter of Monſieur Hevelius, *concerning his Obſervations of the* Moon's Eclipſe, *on* Septemb. 29. *ſt n.* 1670. *and the* Conjunction *of* Venus *and the* Moon, *on the* 11*th of* Octob. *ſt. n.* 1670; *as alſo ſome remarks about the* New Star *near the* Beak *of the* Swan, *and that other in the* Neck *of the* Whale: *together with ſome other particulars of a Philoſ. nature. Here deliver'd in the ſame Tongue, in which it was written.*

NOn potui Reſponſum tuum ad meas ultimas exſpectare, quin rurſus ad Vos ſcriberem, deque recentioribus quibuſdam Phœnomenis *& Obſervationibus, hîc à me feliciter habitis, certiores redderem; inprimis cum videam, meas quales quales Animadverſiones Cæleſtes Illuſtriſſimæ noſtræ* Societati Regiæ *hactenus non omninò diſplicuiſſe.*

Primò, *die* 29. Septembris *ſt. nov. mane*, Eclipſin Lunæ *Cœlo perquam ſereno, ab initio uſque ad finem, ex voto obſervavi. Initium ejus incidit hora* 2. 22′; *quanquam id ipſum vix omnino accuratè obſervari potuerit, ob Umbram Terræ dilutiſſimam: Siquidem, durante Eclipſi, tota Umbra adeò tenuis erat atque diluta, ut omnes præcipuas maculas per eam, meo viginti pedum Tubo, quin & brevioribus, optime conſpicere potuerim.*

Maxima ejus Obſcuratio incidit hor. 3. 50′. Finis verò h. 5. 21′. Tota itaque Duratio fuit hor 2. 59′; & Quantitas vix amplius 9 digitorum. Quibus verò Tabulis, *Eclipſeos hujus Obſervatio accuratius reſpondeat, Vos Judicabitis. Juxta* Rudolphinas *hîc Gedani incidit;*

	h.			*hor.*
Initium	2.37′.5″.	*Secundum Riccioli Tab.*	*Initium*	2.14′.47″.
Max.Obſc.	4. 2. 50.		*Max.Obſcur.*	3.55.37.
Finis	5.28. 35.		*Finis*	5.36.27.
Tota dur.	2.51. 30.		*Tota duratio*	3.21.40.
	dig.			
Quantitas	9. 4. 0.		*Quantitas digit.*	11.43. 0.

Circa Medium hujus Eclipſis hor. 3. 40′. Stellulam quandam incognitam, ac ſolo Tubo conſpicuam, à Luna circa Lacum nigrum Majorem *tectam, clariſſimè conſpexi; ſed exire eam non deprehendi. Deinde, finitâ Eclipſi, jucundiſſimum quoque obſervatu erat, bina Luminaria ſimul ſupra Horizontem videre. Nam priuſquam Luna occideret, Sol oriebatur. Cætera notatu digna ex particulari hoc Typo deprehendetis:*

Ordo Phaſium	Phaſes Lunæ Teleſcopio Obſervata.	Altitudines	Tempora ex Altitudinibus Correct.	Animadvertenda.
		Caudæ Cygni 50°.54.	hor. 12. 8'.34".	
		Caudæ Cygni 50. 25.	12.11.32.	
		Pollucis ♊ 26. 39.	1.28.56.	
		Pollucis ♊ 27. 16.	1.33.17.	
	Penumb. init.		2.10. 0.	
	Initium Eclip.		2.22. 0	*Cœpit Eclipſ. in part.☽æ ſup. circa ſin. hyperb.*
1	1 $\frac{2}{8}$ *dig.*		2.31. 0.	*Umbra ſinū Apollinem & M. Porphyr. ſtring.*
2	2 $\frac{1}{4}$		2.36. 0.	*Lacus niger major tegi incipiebat.*
3	3 $\frac{1}{4}$		2.41.40.	*Umbra ad Inſ. Corſicam pervenerat.*
4	3 $\frac{2}{4}$ *paulo plus*		2.45.50.	
5	4 $\frac{2}{8}$		2.49. 0.	*Pal. Mæotis & M. Ætna plane tectus.*
6	5 *dig. fere*		2.53. 0.	
7	5 $\frac{2}{4}$		2.57. 0.	*Inſ. Besbic. & Inſ. Macra tecta.*
8	6 *dig.*		3. 3. 0.	
9	6 $\frac{1}{4}$		3. 5. 0.	
10	6 $\frac{2}{4}$		3. 8 30.	*Inſ. Melos tegi incipiebat.*
11	7 $\frac{1}{8}$		3.11. 0.	
12	7 $\frac{5}{8}$		3.16. 0.	*Inſ. Rhodus tecta.*
13	7 $\frac{7}{8}$		3.20. 0.	
14	8 $\frac{1}{4}$		3.25 30.	
15	8 $\frac{1}{2}$		3.29. 0.	*Inſ. major Caſpii tegebatur.*
16	8 $\frac{3}{4}$		3.33.40.	
17	8 $\frac{7}{8}$		3.37.50.	
			3.40. 0.	
18	9 *dig.*		3.47. 0.	*Max. Obſc. per J. Leto. & M. Aber. ſe exten.*
19	9 *paulo min.*		3.51.10.	*Pal. Maræotis ſub umbræ ſectione ſubſiſteb.*
20	8 $\frac{2}{4}$		3.57. 0.	
21	8 $\frac{1}{2}$		4. 1.40.	
22	8 $\frac{1}{4}$ *fere*		4. 6. 0.	
		Polluc. ♊ 49°.50'.	4.10.28.	
23	8 *paul. plus*		4.11. 0.	*Inſ. Melos & Rhodus umbrâ exiverant.*
24	7 $\frac{2}{4}$		4.17.20.	
25	7 $\frac{3}{8}$		4.22.25	*M. Porphyrites illuſtrari incipiebat.*
26	6 $\frac{3}{4}$		4.27.35	*Umbra M. Ætnam jam reliquerat.*
27	6 $\frac{1}{4}$ *fere*		4.33.40	
28	5 $\frac{2}{4}$		4.37.37	
29	4 $\frac{3}{4}$		4.44.46.	
30	4 *dig.*		4 50.56.	*M. Argentar. & Inſ. Besbic. illuſtrabantur*
31	3 $\frac{3}{8}$		4.54. 0.	
32	2 $\frac{2}{4}$		4.57. 0.	
33	2 $\frac{1}{4}$ *fere*		5. 1.23.	*Umbra totam fere I. Caſpiam maj. tranſierat.*
34	1 $\frac{5}{8}$		5. 4.45.	
35	1 $\frac{1}{4}$ *dig.*		5. 7.43.	
		Cordis ♌ 25°. 4'8.	5.10.50.	
	Finis Eclip.		5.21.25.	*Fines circa Riphæi montes contigit.*
	Penumb. finis		5.24. 0.	
		Sirii 18°. 54'.	5.28.32.	

Secundo; *die* 11 Octob. *ſt. n. incidit mane, poſt Solis ortum, horâ circiter octavâ, hîc* Gedani, *Conjunctio* Veneris *&* Lunæ, *quam Calculus Rudophinus pariter eodem fere tempore indigitavit; quo videl.* Luna *parte ſuâ inferiori* Venerem *occultare ad* 23″ *minimum debebat. Ad quod rariſſimum ſpectaculum obſervandum me Tubo* 20. *pedes longo accinxeram. Atque quamvis Aer non omnino eſſet defæcatus, nubeſque rariuſculæ hinc inde obvolitarent, Sole pariter jam orto, nihilominus &* Lunam *&* Venerem *clariſſimè conſpeximus, ad horam uſque decimam; imò diutius potuiſſemus, ſi fuiſſet opus: Sed à* Luna, *ut ut* Tabulæ *dictæ Occultationem illam penitus confirmabant, Venus tamen nequaquam tecta fuit, ſed aberat* hæc, *circa veram ſcil. Conjunctionem, à Limbo* Lunæ *inferiori ad* 4, *vel, minimum,* 3. *minuta; ſic ut nulla eo tempore Occultatio, ſed tantum arctus Tranſitus extiterit. Volupe profecto erat jucundiſſimum illud Spectaculum, de die, Soleque ſplendente, adeò diſtinctè ac dilucidè contemplari.* Luna *namque erat tenuiſſima, ad* Conjunctionem *propendens, valdeque* Corniculata*: At* Venus *propemodum plena, & corpore valdè diminuto. Si non adeò vaporoſus fuiſſet Aer, frequentius accuratiuſque diſtantias* Veneris *&* Lunæ *à* Jove, *aliiſve quibuſdam Fixis cepiſſem; ut jam non niſi eas, quas mitto, obſervare licuerit. Horâ 7. 40′. eo ipſo die tres* Parelii *apparuerunt. Quid Vos hiſce de rebus deprehendiſtis, primâ occaſione exſpecto.*

Tranſitus Lunæ Supra Venerem, Ao. 1670. die 11 Octob. ſt. n. Obſervatus.

GEDANI

A

Johanno Hevelio.

Juxt. hor. amb. mane. Hor. ′. ″.		*Distantiæ & Altitudines.* °. ′. ″.	*Tempus ex altitud. Correct.* Hor. ′. ″.
3 47 20	*Altitudo Lucidæ* ♈	41. 45. 0	3. 54. 10
3 50 35	*Eadem altitudo*	41. 11 0	3. 57. 28
5 47 44	*Diſtantia* ♀ *in* ♃.		5. 54. 44
5 48 35	*Diſt.* ☽ *limb. orient. à* ♃	35. 25. 30	5. 55. 35
5 51 59	*Diſt.* ♀ *à* ♃.	35. 50. 0	5. 59. 0
5 53 40	*Diſt.* ☽ *limb. orient. à* ♃.	35. 29. 10	6. 0. 40
6 12 30	*Diſt.* ♀ *à* ♃.	35. 50. 20	6. 6. 0
6 14 3	*Diſt.* ☽ *limb. orient. à* ♃.	35. 37. 35	6. 8. 0
6 37 0	*Diſtit.* ♀ *à* ☽, *quantum nu-*	6. 0	6. 51. 0
	do oculo dijudicari potuit.	5. 0	7. 7. 0
7 12 0	*Diſt.* ♀ *à* ☽ *limbo infer.*		
7 17 0	*Diſtit.* ♀ *à* ☽, *limb infer.*	4. 0	7. 12. 0
7 35 0	*Venus clarè apparuit, ſed*		7. 30. 0
	Luna non ampl. ob nubec		
7 45 0	*Venus; ſimul tres* Parelii		
	apparuerunt.		7. 40. 0
9 11 0	*Venus permanſit conſpicua.*		9. 12. 0
9 15 48	*Altitudo Solis.*	19. 8. 0	9. 17. 20
9 17 39	*Altitudo Solis.*	19. 58. 0	9. 19. 4

Tertio, *Nova illa Stella ſub* Capite Cygni, *quæ initio* Tertiæ *videbatur* Magnitudinis, *mirum in modum Menſe* Septembri *decrevit, adeò ut* 14. Octobris *nullâ ratione amplius* Sextante *obſervari à me potuerit; licèt omnem adhibuerim diligentiam. Nam vix ac ne vix quidem nudo oculo animadverti potuit; adeò ut ab hac die illam amplius non viderim, ut ut ſingulis diebus Cœlo ſereniſſimo omnes oculorum nervos ad eam intenderim. Altera verò* Nova *in* Collo Ceti *ad medium uſque menſis* Octobris, *Mandibulæ* Ceti *aqualis ferè extitit magnitudine, & claritate eam propemodum ſuperavit; adeò ut hoc Anno* Secundæ *fuerit magnitudinis, ac major quàm præcedentibus annis, excepto Anno* 1660, *quo major etiam* Mandibulâ Ceti *à me fuit deprehenſa. Aliis temporibus non memini eam* Tertiæ *Magnitudinis Stellas ſuperaſſe. Certum igitur eſt, ipſam non eandem ſemper præſe ferre Magnitudinem nec claritatem, ut ut in maximo ſuo exiſtat incremento: heſternâ verò die multum decreverat.*

Quod reſtat, Lentem illam Domini Burattini pro Tubo 70. *pedum elaboratam necdum explorare licuit. Idem promiſit aliam multò longiorem, pedum ſcil.* 140; *quam ubi accepero, illarum vires ſimul explorabo, Voſque deinde de omnibus & ſingulis certiores reddam.*

Succinum, *quod ſigillo cedit (de quo ante hac) inter omnium rariſſima quæ apud nos reperiuntur, meritò habetur; quippe dum vixi, ſi bina illa fruſta, quæ penes me habeo, excipias, ne unquam quidem vel minimum fruſtulum vidi, ut ut tale à multis annis ſollicitè quæſiverim. Interim ut Illuſtriſſimæ* Societati *promptitudinem meam declarem, illi ex binis illis fruſtulis, quæ penes me ſunt, alterum proximo vere navi quadam tranſmittam; terrâ quippe id fieri nequit ſi faciem, figuram, atque inſignia impreſſa omnino retinere debeat. An unquam fruſtulum, altera parte molle, alterâ duriſſimum poſſim impetrare, valde dubito.*

In Machina mea Cœleſti alacriter & conſtanter, quantum occupationes aliæ unquam permittunt pergo. Valete & porro favete veſtro Conſodali, Illuſtriſſimæ Societati R. *devinctiſſimo* Joh. Hevelio. *Dabam* Dantiſci 1670. D. 31. *Octobris.*

Lunæ

Lunæ ad Fixas Saturnumque,

Anno 1671.

Appulſus obſervabiles, prædicti, & ad Meridianum Latitudinemque *Londini* accurate ſupputati à *Joh. Flamſteadio* Derbienſi-Anglo.

1. ANno 1671. Januarii 4°, *Luna appellit ad ſtellam in altero flexu Auſtrali aquæ* Aquarii, *Magn.* 5. *cujus long.* ♓ 12°. 18′. *Lat.* 2°. 49′. *Auſtr.*

Londini, hujus occultationis,

	h. ′ ″			′ ″	
Initium	6. 57. 10	*Lat* *ª *à centro Lunæ in*	*Ingr.*	15. 05	*Auſt.*
Finis	7. 14. 22		*Emerſ.*	16. 51	
Mora	0. 17. 12				

2. Febr. 13. *poſt mediam noctem ſequentem celebratur appulſus Lunæ ad ſtellam honoris* 4. *quæ vocatur Borealis trium ſub ventre* ♍; *cujus Long.* ♍ 9°. 53′. 5″. *Lat.* 1°. 20′. 30″. *Auſtr.*

Londini, Stellæ dictæ,

	h.			
Immerſ.	14°. 24′. 45″.	*Lat.* *ª *à centro Lunæ in*	*Immerſ.* 7′. 05″	*Auſt.*
Emerſ.	15. 30. 54.		*Emerſ.* 1. 20	
Mora ſub ☽ª.	1. 06. 09.			

h.

3. Mart. 4. 8. 46'. *p. m. ſecundùm* Wingi *Ephemerides Luna congreditur cum Media trium in cauda* Arietis, *cujus eo tempore long.* ♉ 17°. 19'. 8". *Lat. Sept.* 2°. 50".

Londini,

	h.		
Subingr.	10. 14'. 52".	*Lat. Stellæ à centro* ☽*æ in*	*Immerſ.* 16'. 07".
Detectio **æ*	10. 31. 13.		*Emerſ.* 15. 39.
Mora ſub ☽*a.*	0. 16. 21.	*Max. appropinquatio centror.*	15. 53.

4. April. 12. *alterâ horâ poſt occaſum Solis Luna appellit ad* Spicam Virginis, 1*æ Magnit.*

	Londini. *h.*	*Derbiæ.* *h.*			*Lond.* ′ ″	*Derb.* ′ ″
Subing.	9.05'.53"	9.01'.00"	*Lat.* * *à centro* ☽*æ in*			
Emerſ.	10.20.35	10.13.45		*Immerſ.*	3.08	2.39 *A.*
Mora	1.14.41	1.12.39		*Emerſ.*	4.33	4.48 *B.*

5. Maii 6. *Luna, poſt occaſum Solis, Borealem trium ſub ventre* ♍ *(magn. 4tæ) cooperiet: Cujus Long.* ♍ 9°. 53'. *Latit.* 1°. 20'. *Bor.*

Londini Stellæ,

	h.			
Subingr.	9. 09'. 37"	*Lat. à centro* ☽*æ in*	*Subingr.* 1'. 54".	*Bor.*
Emerſ.	10. 14. 56		*Emerſ.* 8. 10.	
Mora.	1. 5. 19			

6. Maii 21. *Saturno Cynthia jungitur poſt mediam noctem ſequentem.*

Londini centri Saturni

h.				
Ingreſſus 14 29'. 17".	*Lat.* ♄ *à centro* $☽^a$ *in*	*Immerſ.* 8'.52".	*Bor.*
Emerſio 15. 31. 23.		*Emerſ.* 4. 27.	
Mora ſub $☽^a$. 1. 02. 06.			

h.

7. Julii 17. 13. 8'. *Luna, Authore* Wingo, *cum Stella, 5ti honoris dicta, in Lino Boreo ♓um à Connexu præcedens: ejus tunc temporis locus* ♈ 23°. 7'. 26". *lat.* 1°. 38' $\frac{1}{2}$ Bor.

Londini ſtellæ cum Luna

	h.		
Congreſſio	12. 8. 32.	*Lat. à centro* $☽^a$ *ad Boream in*	*Immerſ.* 14'. 50".
Sejunctio	12. 52. 21.		*Emerſ.* 12. 10.
Mora ſub ea	0. 43. 49.		

h.

8. Septemb. 9. 10. 54'. *Luna juxta Ephemerides cum ſtella Lucis 4tæ in Lino Auſtrali ♓um lucidiorum trium media, cujus long.* ♈ 12°. 53'. *lat.* 1°. 5 $\frac{1}{2}$. *Bor.*

Londini Occultationis

	h.		
Initium	10. 23'. 48".	*Stel'æ à centro* ☽. *Lat. ad Bor. in*	*Immerſ.* 15'. 20".
Finis	10. 59. 33		*Emerſ.* 11. 11.
Duratio	0. 35. 45.		

9. Octob. 9. *poſt mediam noctem ſequentem, Luna ad* Pleiadas *appellit quarum loca ad inſtans tempus proveniunt.*

		long.	*lat.*	*magn.*
Occidentalis lucidior	♉	24°. 41'. 48".	4°. 9'. 40".	5.
Occidentalis Borealior		24. 52. 07.	4. 31. 36.	6.
Infima occidentali proxima		24. 58. 37.	3. 53. 30.	6.
Sequens Borealior		24. 59. 07.	4. 23. 56.	6.
Media & lucida		25. 19. 37.	4. 00. 00.	3.
Quæ eſt in cuſpide ad ortum		25. 45. 07.	3. 51. 20.	5.
Orientalium ſuperior		25. 45. 07.	3. 54. 00.	7.

Occidentalis lucidioris inter Pleiades

	h.		
Immerſ.	16.15'.13".	*Lat. à centro* ☽*æ ad Bor. in*	*Ingreſſu* 1'. 22".
Emerſ.	17.21.20.		*Egreſſu* 2. 15.
Mora.	1.06.07.		

Mediam & Lucidam Pleiadum Luna nobis

	h.		
Subducit	17.33'.07".	*Lat. lucidæ à centro* ☽*æ ad Auſtr. in*	*Ingr.* 7'.16".
Retegit	18.29.23		*Emerſ.* 6.37.
Detinet	0.56.16		

Infimam occidentali proximam Luna

	h.		
Attingit	17. 4'. 36".	*Lat.* * *à* ☽*a ad Auſtr. in*	*Ingreſſu* 14'. 07".
Detegit	17. 40. 34.		*Emerſ.* 13. 40.
Retinet	0. 35. 48.		

Succedit autem quæque Phaſis alteri hoc ordine :
Octobris 10*mo mane.*

Phaſ.	h. ' "	
1	4.15.13.	*Luna Occidentalem lucidiorem attingit.*
2	5.04.36.	*infimam occidentali proximam obſidet.*
3	5.21.20.	*occidentalis lucidior emergit.*
4	5.33.07.	*media & lucida luce nobis capta eſt.*
5	5.40.34.	*infima occidentali proxima evadit.*
6	6.29.23.	*media & lucida Pleiadum remittitur.*

10 Novemb. 3. *ineunte nocte Luna iterum Mediam in Lino Auſtrali,* **um aggreditur, cujus tunc temporis locus verus* ♈ 12°. 53'. 40". *cum Lat.* 1°. 05'. 03". *Bor.*

Loudini Luna ſtellam

	h.	′	″			′	″
Subripiet	7.	47.	07.	Lat. *ª à centro	Ingr.	8.	13½.
Remittit	8.	52.	45.	☽ª ad Bor. in	Emerſ.	0.	19½.
Retinet	1.	05.	38.				

11. Decemb. 3. 14. 30 (h. ′); *juxta Ephemeridas, Luna Pleiades aſſequitur.*

Pleiadum occidentalis Lucidior à Luna

	h.	′	″			′	″
Capta eſt	14.	16.	46.	Lat. *ª à centro	Ingr.	1.	46.
Remiſſa	15.	11.	34.	☽ª ad Bor. in	Emerſ.	2.	15.
Retenta	0.	54	48.				

Mediæ & Lucidæ Pleiadum

	h.	′	″			′	″
Subingreſſus	15.	21.	38.	Lat. *ª à centro ☽ª	Ingr.	3.	02.
Retectio	16.	16.	18.	ad Auſtr. in	Emerſ.	0.	55.
Mora ſub ☽a	0.	54.	40.				

Infimæ occidentali proximæ

	h.	′	″			′	″
Subtectio	14.	50.	06.	Lat. à centro	Ingreſſ.	10.	34.
Emerſio	15.	36.	06.	☽ª ad Auſtr. in	Exitu	9.	04.
Mora	0.	46.	00.				

Ultimæ, quæ in cuſpide eſt ad ortum,

	h.	′	″			′	″
Immerſio	16.	09.	19.	Lat. *ª à centro	Ingreſſ.	9.	56.
Emerſio	16.	53.	09.	☽ª ad Auſtr. in	Exitu	7.	55.
Mora ſub ☽ª	0.	43.	50.				

Cæterum hujus phænomeni tali ordine ſuccedunt Phaſes:

Phaſ.	h. ′ ″	
1	14.16.46.	*Occidentalis lucidior ſubripitur.*
2	14.50.06.	*infima occidentali proxima obtegitur.*
3	15.11.34.	*occidentalis lucidior emergit.*
4	15.21.38.	*media & lucida obſcuratur.*
5	15.36.06.	*infima prodit occidentali proxima.*
6	16.09.19.	*quæ in cuſpide ad ortum occupatur.*
7	16.16.18.	*media & lucida ſe à Luna exerit.*
8	16.53.09.	*quæ in cuſpide ad ortum evadit.*

All thoſe that deſire the Advancement of *Aſtronomy*, and have conveniency of making Obſervations, are herewith ſollicited to apply themſelves with all diligence and exactneſs to obſerve theſe recited Appearances.

Accompt of three Books.

I. *ORIGO FORMARUM & QUALITATUM; juxta Philoſophiam Corpuſcularem Conſiderationibus & Experimentis Illuſtrata*, *à* Roberto Boyle *Nobili* Anglo, *è* Societ. Regia. *Oxon.* 1669. *in* 12°.

HAving formerly, (*Numb.* 11.) given the Contents of this Inſtructive Treatiſe, we again take notice of it here, only to let Forreigners know, that the ſame is now Printed in the *Latin* Tongue, after it had been publick in the *Engliſh* ſince *April*, of the year 1666.

II. *METALLOGRAPHIA, or an Hiſtory of Metals; by* John Webſter, *Practitioner in Phyſick and Chirurgery*, London, *for* Walter Kettilby *in Pauls Church-Yard.* 1670. *in* 4°.

THe Author of this Hiſtory hath with much diligence and curioſity deliver'd therein (to ſpeak of it in general,) the ſigns of Ores and Minerals both before and after digging ; the Cauſes and Manner of their Generation ; their kinds and differences, and a deſcription of ſundry new Metals, or Semi-metals, as he calls them ; together with a diſcourſe of their Vegetability, and the Diſcuſſion of many difficult Queſtions belonging to Chymiſtry. Collected out of the moſt approved Authors, that have written in Greek, Latine, High-Dutch and Engliſh : With ſome Obſervations and Diſcoveries of his own.

But in *particular*, he treateth,

1. Of the Excellency and Uſefulneſs of the knowledge of Minerals and Metals ; and of the Antiquity of the melting, refining, and accommodating of them to humane Uſe ; and the cauſe of the non-proficiency of Metallick skill, eſpecially here in *England*.

2. Of the Authors, that have written of this Subject : Among whom he chiefly recommends *Agricola*, *Cæſalpinus*, *Cæſius*, *Sarepta Matheſii*, *Kentmannus*, *Lazarus Erker*, *Chriſtophorus Eucelius*, *Caſpar Schwenckfeldius*, *Martinus Rulandus*, *Baſ. Valentinus*, *Paracelſus*, *Joh. Bapt. van Helmont*, *Quercetanus*, *Mylius*, *Beguinus*, *Sala*, *Faber*, *Libavius*.

3. Of the Generation of Metals, and whether they grow like Vegetables : where the Cauſes, aſſigned by the moſt approved Authors for their Generation, are taken notice of.

4. Of the ſigns and Diſcovery of Mines and Ores.

5. Of the Minerals, ſaid to have affinity to Metals, as thoſe that are call'd *Cachimiæ* (i.e. *imperfectæ metalli mineræ*,) *Marchaſites*; *Fireſtones*.

6. Of *Gold*, and the ſeveral ſorts of it, as they are produced by Nature, and in what manner they are ſeverally found; as alſo of the Stones, Rocks and Flints of Gold, and the ſtriking paſſages wherein 'tis found ; together with ſome wayes of beating, ſifting and waſhing the Ores thereof, *&c.*

7. Of *Silver*, and the ſeveral wayes of getting the Ore of it ; as alſo of its Mines, Conditions, and ſtriking paſſages : of Silver found pure by Nature ; and of thoſe ſorts that muſt be

purified, their colors, mixtures, and ſeveral coats, wherein they are wrapt up: together with the method uſed in the Indies of refining Silver-ore.

8. Of *Copper*, its ore, ſtones, operation, ſigns, ſeveral ſorts, and the various preparations it undergoes before it be pure: together with a diſcourſe of the Native and Factitious *Orichalchum*; of the Corinthian Braſs; and of ſome other Compoſitions, which Copper undergoes with other Metals or Minerals; and of ſome Medicins prepar'd out of it.

9. Of *Iron*, its ores, Operations, Stocks, Floats, Paſſages; ſeveral ſorts of Iron-ſtone, and of Medicins prepared of this Metal.

10. Of *Lead*, its Ores, ſeveral ſorts, coats and matrixes; and ſome Medicins it yields.

11. Of *Tin*, its Ores and operations, *&c.*

12. Of the ſeveral ſorts of *Mercuries*; of Cinnaber, and its ſeveral ores and paſſages; and how it is gotten and refined; as alſo of the ſeveral ſorts of Medicaments it affords: where the Author diſcourſes particularly of the *Præcipiolum* of *Paracelſus* and *Van Helmont*.

13. Of *Antimony*; of Biſmuth, or Zink, or Spelter; and of *Cobalt*; together with their Qualities, Ores and Medicaments prepared out of ſome of them: as alſo of Native *Electrum*.

14. Of native *Cadmia*, native *Borax*, *Talk*, *Load-ſtone*, *Bloud-ſtone*, *Lazul-ſtone*, &c.

15. Of the Tranſmutation of Metals; which this Author endeavors to aſſert; taking pains to examine and open the nature of Tranſmutations, and to ſhew ſome ſorts of them, that are common and obvious, and full as ſtrange as this of Metals, thereby to evince, that it is no ſuch impoſſible or ſtrange thing, as many make it to be.

III. *LETTERA di* Franceſco Redi *ſopra alcune Oppoſitioni fatte alle ſue Obſervationi intorno alle VIPERE. In* Firenze, 1670. *in* 4°.

MOnſieur *Charas* having endeavoured in his Book, intituled *Nouvelles Experimences ſur la Vipere*, not long ſince tranſlated out of *French* into *Engliſh* (of which an Account was given in *Numb.*54;)*firſt*, by Experiments to confute the opinion, that the Venom of Vipers reſides in the yellow liquor contain'd in the Bagg about the Vipers Teeth, and then to maintain on the contrary that it conſiſts in their vexed and enraged Spirits; This Author being concerned in this Controverſie, and having made out the former of theſe opinions, as he thinks, by numerous Experiments; doth now in this Letter affirm, that he repeated his former Tryals again and again, and is thereby altogether confirmed in what he then deliver'd about the ſeat of the Vipers poyſon: concluding with more aſſurance,than ever,that the Venom of the *Italian* Vipers doth not conſiſt in an imaginary *Idea* of revengefull Choller, but in that yellow liquor above mentioned; which liquor, he ſaith, if it chance to ſhed or ſpread it ſelf over the mouth and pallat of the Viper,may make that *Saliva* poyſonous, which moiſtens the throat of that animal. Whence he thinks, it would be uſefull,that the Learn'd Authors of the *French* Experiments did make new Obſervations; and if they ſhall be found conform to thoſe they have printed,and indeed contrary to *his*,that then it might be agreed upon,that there was a truth diſcover'd hitherto unknown,*viz.*That the Venom of *French* Vipers conſiſts in a cholerick and vindicative idea of the Fancy; but that of the *Italian*,hath its ſeat in that yellow juyce ſo often ſpoken of:And that,if this latter prove true,it will be no untruth to affirm,that, if a Viper by biting ſhould have conſumed both all the proviſion, which is lodged in the baggs of her teeth, and that alſo, which from the neighbouring parts may be furniſh't, that then her bitings would not be mortal: which,*he ſaith*, he hath heretofore affirmed,and doth ſo ſtill; although M. *Charas* deny it, declaring,that one only Viper being enraged is able to kill as many animals as ſhe ſhall bite.

In this Vindication,our Author alledgeth a good number of freſh Experiments,to maintain his opinion; and beſides them, divers very remarkable obſervations, to ſhew, that Vipers do more eaſily kill ſome Animals,than others; that their biting in ſome places is more dangerous than in others; and that a plentifull effuſion of bloud after the biting is capable to ſave the bitten Animal, *&c.*

Among the many new Experiments he relateth one, which is not to be paſſed by; *viz.* That he had put up in a Glaſs Veſſel the poyſonous liquor taken out of two hundred and fifty Vipers, with a deſign to make various tryals therewith, as often as he ſhould have leiſure; but that being diverted by many avocations from accompliſhing his purpoſe, it came to paſs that that juyce turn'd to a kind of glue, of the colour of Amber, and after the lapſe of thirty days, it became dry and friable, and eaſily reducible to powder, and that having pulverized it, out of a deſire to ſee whether this powder, being put into wounds, made by him in Pullets and Pigeons, did keep the ſame force of poyſoning; he found, that in a little time there dyed all the Pullets and Pigeons, into whoſe wounds he had put a quantity of this powder.

A Note.

WHereas *Numb.*64.p.2071.l.27. mention is made of a Letter of Dr. *Wallis* about the Moons *Perigæum* in the matter of *Tydes*; the Reader may be pleaſed to take this further notice, That that mention is to be underſtood to have been made in the *Latine* Verſion given by the ſaid Doctor, of his Anſwer to the Objections to his *Hypotheſis*; (for in the *Engliſh*, Printed Numb.16, 'tis not:) In which Verſion ſent long agoe by way of Letter to the Publiſher, are theſe words; (to be inſerted after thoſe of Num.16.p.286.l.11. viz. *The Niceties are to be adjuſted in time, from particular Obſervation*;)

Et quidem, ſi ad minutias deſcendere libuiſſet, habenda fuiſſet ratio, tum Apogæi *&* Perigæi *Lunæ, tum Obliquitatis Orbitæ Lunaris ad* Eclipticam *comparatæ, & Interſectionum, quas Caput & Caudam* Draconis *dicunt. Sed & monendum fuiſſet, Terræ Motum Annuum atque Diurnum, cùm non eundem ſeu parallelos Axes habeant, ſe mutuo nunc magis nunc minus interſecare: Item, Iuundationes* Nili, *aliorumque aliquot fluviorum, ſtatis Anni temporibus factas, ad hujuſmodi forte cauſam referri poſſe: fortaſſis & ſtatos ventos. Sed hæc intacta plane prætereo, aliaque hujuſmodi multa; quæ tamen, ſi quando ad particularia deveniendum erit, conſideranda erunt.*

ERRATA.

IN Numb. 65, were left uncorrected theſe faults of the Preſs. P. 2102. *l.* 13, 14. in ſtead of *two Maggots, and three mites*, read, *ſecondly, Maggots, thirdly, Mites*; as before theſe words it ſhould be, *are bred firſt Hexapods. p.*2014.*l.*17.*r. firſt ſtarted.*

*In this Numb.*p.2022.l.8.r. *up to.*p.2025.l.40. remove the words, *M. Argentar, &c.* which are placed in the next line, to this 40th line. *Ibid.*l.48.r. *Finis.*

LONDON,
inted for *John Martyn*, Printer to the *Royal Society*, 1671.

Numb. 67.

PHILOSOPHICAL TRANSACTIONS.

Januar. 16. 16$\frac{70}{71}$

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An Accompt of ſundry Experiments made and communicated by that Learn'd Mathematician, Dr. Eraſmus Bartholin, *upon a Chryſtal-like Body, ſent to him out of* Iſland.

BEfore we come to the Relation it ſelf of theſe Experiments, we cannot but premiſe an *Extract* of the Obliging Letter, written to the Publiſher, by the ſaid Doctor *Bartholin* from *Copenhagen* Febr.27. 1670; Engliſh't as follows;

—I Know the many Excellencies of the Engliſh Nation, and that innumerable new things in the matter of knowledge iſſue thence, and diffuſe themſelves through *Europe*; though they arrive ſomewhat ſlowly hither. We are here preſſed with ſo many cares, that though we want no will to contribute ſomething to the advancement of knowledge; yet being deſtitute of the leiſure neceſſary for it, and diverted by two difficult Profeſſions, the Medical and Mathematical, we can rather admire the performances of others, than engage for any thing of our own. But yet, not altogether to fruſtrate your expectation, and to give you ſome Teſtimony of my affection and endeavors, I here ſend you ſome Experiments made with a certain Chryſtal-like Stone, ſent me out of *Iſland*, together with a piece of that Stone, to make the Tryals your ſelf. Farewell.

For the reſt, we are now labouring to publiſh a more corrected and better digeſted Edition of *Tycho Brahe's* Works; a buſineſs of much time and exceeding great labour: Which care while I am engaged in, I muſt lay aſide other matters. Yet I hope, that my part in this work will ſhortly be over; there remaining almoſt nothing, but to provide the charges neceſſary for the Impreſſion; which all true Lovers of Aſtronomy cannot but have a great concern for.

This Letter being ſent to *Hamborough* to that Ingenious Phyſitian, Dr. *Matthias Paiſenius*, with a deſire to tranſmit it to *London*, this worthy Perſon was pleaſed to incloſe it in one of his, written to the Publiſher; which, ſince it treateth of the ſame argument (I mean, the *Iſlandian* Stone,) will not be amiſs to ſubjoyn here the Breviate of.

—— *The Obſervations of the Excellent* Bartholin *upon the* Iſland-Chryſtal *are indeed conſiderable as well as painfull. We have here alſo made ſome Tryals of it upon a piece, he preſented me with; which confirm his obſervations. Mean time, we found it ſomewhat ſciſſile and reducible by a knife into thin* lamina's *or plates, which, when ſingle, ſhew'd the Object ſingle, but laid upon one another, ſhew'd it double; the two images appearing the more diſtant from one another, the greater the number was of thoſe thin plates laid on one another. With ſubmiſſion to better judgements, I think it to be a kind of* Selenites. *Some of our curious men here were of opinion, that the* Rhomboid *figure, proper to this Stone, was the cauſe of the appearances doubled thereby. But having tryed, whether in other Tranſparent Bodies, of the like Figure, the like would happen, we found no ſuch thing in them; which made us ſuſpect ſome peculiarity in the very Body of this Stone.*

Theſe Letters being thus premiſed, we now come to relate the Brief of the Obſervations and Experiments themſelves; referring the more Curious Reader to the larger Accompt of them, and their Mathematical Demonſtrations, as they are to be found in the Printed Book, entitul'd *Eraſmi Bartholini Experimenta Chryſtalli Iſlandici Diſ-Diaclaſtici; quibus mira & Inſolita* REFRACTIO *detegitur.* Hafniæ A. 1669.

1. The Inhabitants of *Iſland* and our own Merchants inform us, *that* this kind of Chryſtal is found in divers places of that Country; but chiefly digg'd out of a very high mountain, not far from the Bay of *Roerfiord*, which lies in 65. degr. *Latitude*; *that* that Mountain reacheth Southward, and hath its whole outſide made up of this ſubſtance, without a neceſſity of digging deep for it; *that* it is cut out by Iron-tooles, in bigneſs of a Cubick foot, or ſomewhat better: and *that* out of its corners there is ſometimes found grown out a harder matter, not unfit to cut glaſs, of a figure different from that of the whole maſs, and approaching to that of Diamonds.

2. The Figure of this Chryſtal-ſtone is like a *Rhombick* or *Rhomboid Priſme.* Nor hath the whole Body that Figure only, but all the parts of it, when broken into ſmall pieces, keep the ſame; except that in ſome caſes the ground, whence 'tis digged, yields ſuch as are of a Triangular Pyramid-figure.

3. This Subſtance is Electrical, attracting (to ſpeak with the Vulgar,) when heated, ſtraw, Feathers, &c.

4. It is not ſo hard, as to endure poliſhing: Nor is it eaſily conſumed; nor reduced into a *calx* but by a ſtrong fire, by which it will turn into a ſubſtance like unſlaked lime, which will heat a wet finger, and, when ſprinkled with fountain-water, will buble up, and become like common lime.

5. *Aqua fortis* being by me dropp'd upon it, it was corroded, and the ſuperficial parts were put into a motion with ſome noiſe. And when I pulverized it in a mortar, Aqua fortis, powred on it, made it boyle, till all was diſſolved, and the *Menſtruum* tinged with a yellowiſh colour. Then putting it into a Thermometer furniſht with a hollow glaſs-ball, it conſiderably ſhew'd the difference of Heat and Cold. The powder being diſſolv'd in *Aqua fortis*, I dropp'd ſome Spirit of *Vitriol* upon it, to ſeparate the thick from the thin, and to precipitate the white *calx* to the bottom.

6. The ſides of this Body are exceeding ſmooth; which is then eaſily obtained, if a thinner piece be nimbly broke aſunder with your finger. But if you ſtrike it with a hammer, the percuſſion hath not the ſame effect upon, nor is equally reſiſted from every part; whence the ſmooth ſides of this Mineral become often ſcabrous. The whole Body is rather clear than bright, of the colour of limpid water; but that colour, when it hath been immerſed in water and dryed again, becomes dull. Hence it is, that in its native place the upper ſurface is darkiſh; becauſe of the Rains and Snows fallen upon it. Sometimes there appear alſo ſome reflections of colours, as in the Rain-bow. The Angles are not pointed alike, all the flat ſides being obliquely inclined to one another. The oppoſite plains are parallel.

7. In this Chryſtallin Priſme, two of the plain Angles are always acute, and the two other obtuſe; and never any of them is equal to the collateral Angles of the Inclinations.

8. The Objects ſeen through it, appear ſometimes, and in certain poſitions of the Priſme, double: Where 'tis to be noted, that the diſtance between the two images is greater or leſs, according to the different bigneſs of the Priſme; inſomuch that in thinner pieces this difference of the double image almoſt vaniſheth.

9. The Object appearing double, both images appear with a fainter colour; and ſometimes one part of the ſame *ſpecies* is obſcurer than the other.

10. To an attentive Eye, one of theſe Images will appear higher than the other.

11. In a certain poſition the Image of an Object, ſeen through this Body, appears but ſingle, like as through any other Tranſparent Body.

12. We have alſo found a poſition, wherein the Object appears ſixfold.

13. If any of the obtuſe Angles of this Priſme be divided into two equal parts by a line, and the viſual rays do paſs from the Eye to the Object through that line, or its parallel, both Images will meet in that line, or in another parallel to it.

14. Whereas Objects, ſeen through Diaphanous Bodies, are wont to remain conſtantly in the ſame place, in what manner ſoever the tranſparent Body be moved, nor the Image on the Surface move except the Object be moved; we have obſerved here, that one of the Images is moveable, the other remaining fix; although there be a way alſo, to make the fixed image moveable, and the moveable fix in the ſame Chryſtal; and another, to make both moveable.

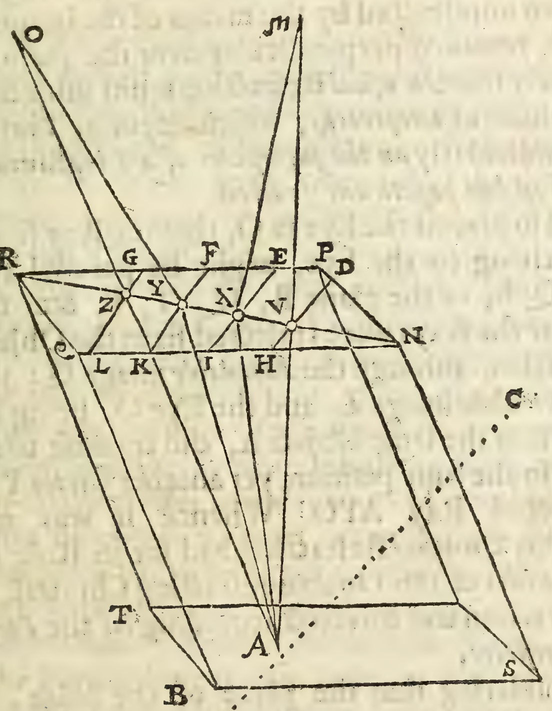
15. The *Moveable* Image doth not move at random, but always *about* the *Fixed*, which while it turneth about, it never deſcribeth a perfect Circle but in one caſe.

16. *Dioptricks* teach, that a Diaphanous Body, having one only ſurface, ſends from one Object but one Image refracted to the Eye; and having more Surfaces than one, it repreſents one Image in each; But whereas in our ſubſtance there occurs but one plain ſuperficies to the Eye and yet a double image of one Object; it concern'd us to conſider, whence this double image might be cauſed. *Two* ways offer'd themſelves to us, *Reflection* and *Refraction*. How *Reflection* could perform it, was difficult to find. For, having dulled the clearneſs of the two plain ſides of our Chryſtallin Priſme, thereby to make them unfit for Reflecting the light; the Rays being directed through its upper and lowermoſt ſuperficies, the image

ſtill appear'd double. Again, two *ſpecies* appearing through a great Priſme, upon breaking of the ſame into pieces and ſo reducing it into divers ſmaller ones, it came to paſs, that through each of theſe leſſer portions the ſame object was ſeen always double. Whence I Collected, that if it ſhould be ſaid, that *one* of the images proceeded from the Reflection of the plain *ſides*; the former of theſe Experiments would diſcountenance that aſſertion. But then if another ſhould derive the cauſe from ſome internal Reflection of the Surfaces of this Body, certainly the ſame effect would not have been found in every one of its parts, but the double appearance, that was exhibited in the ſmalleſt portion, would have been multiplied in a greater bulk.

Reflection therefore not ſatisfying, we recurred to *Refraction*. But, whereas 'tis known, that no image can paſs through two Diaphanous Bodies of a different nature, but by Refraction, and that one image ſuppoſeth one Refraction; it did follow, that, if Refraction were made the cauſe of this *Phœnomenon*, there would be a double Refraction for a double image. And, foraſmuch as the Appearances of our *Iſland*-Chryſtal are not of the ſame kind, but one of them is fixt, the other moveth, we ſhall alſo diſtinguiſh the Refractions themſelves, which refract the double Rays arriving to the Eye, and call the one, which ſends the *Fixt* image refracted to our ſight, *Uſual*; the other, which tranſmits the *Moveable* to the Eye, *Un-uſual*. And hence, namely, from this peculiar and notable propriety of the double Refraction in this Iſland-ſtone, we have not ſcrupled to call it *Diſ-diaclaſtick*.

This being ſuppoſed, it will not be irrational to ſuſpect, that theſe two Refractions proceed from different principles. For, ſince it is commonly known from *Dioptricks*, that an Object, by viſual rays affecting the Eye, exhibits ſome Image on the *Superficies* of the Diaphanous Body, which Image is but one, as long as the *Superficies* is one, and the upper plain-parallel to the lower; as alſo, that if, the Eye remaining ſteady, the Diaphanous Body be moved, that image remains always fixt, as long as the Object, whence it comes, remains unmoved. Wherefore in this Tranſparent ſubſtance, the Image which appears fixt, may proceed according to the ordinary Laws of *Uſual* Refraction; but that, which moveth, and is carried about according to the motion of the Diaphanous Body, while the Object remains un-ſtirr'd, ſheweth an *Un-uſual* kind of Refraction, hitherto un-obſerved by *Dioptricians.*



Hence, that I might examine the nature and difference of both, I put, upon ſome Object, as the point A, the Priſme of my Double-refracting Chryſtal N, P, R, Q, T, B, S; and the Eye M, being perpendicularly poſited over the upper plain of the Priſme N, P, R, Q, I noted, whether there was any Refraction of the point A, (for the *uſual* Laws of Refraction teach, that there is none.) But the Perpendicular Ray of the Eye was obſerved to paſs not through the *Moveable* but the *Fixed* Image; thereby being conformable to the Rules of *Vſual* Refraction, as ſtriking the Eye unrefracted, ſo that the Eye, the Image, and the Object, were ſeen in the ſame Line. But, when in the ſame ſcite of the Eye, the Object A, did alſo exhibit the other Image X, at no ſmall diſtance from the former; I took notice, that this Object A, was not ſeen unrefracted by the means of the image X, though the Eye M, remain'd perpendicular over the plain; and that conſequently this *Vn-uſual* Refraction is not ſubject to the received Axiome of *Dioptricks*, which imports, *That a Ray falling* perpendicularly *on the ſuperficies of a Diaphanous Body, is not refracted, but paſſeth unrefracted.*

Next, I ſo placed the Eye in O, that the Ray from the Object A, arriving to the Eye, might be parallel to the lines RT and Q B, of the plane R, Q, T, B, &c. then it appear'd, that the Rays were trajected from the Object A, without Refraction, through the *Moveable* image Q; the Object A, the moveable image Z, and the Eye O, being in the ſame line; and that the ſame Object A, did tranſmit to the Eye O, remaining in the ſame poſition, yet another *ſpecies* Y; through the Refracted Ray AYO Whence it was manifeſt to me, that this *Vn-uſual* Refraction had for its Rule the *Parallel* of the *Sides* of this Double-refracting Chryſtal, while the *Vſual* Refraction was directed according to the *Perpendicular* of the *Superficies*.

But conſidering that the place of the point, appearing through our Diaphanous Body, cannot eaſily be determin'd, as being only obvious in the uppermoſt part; we ſhall add the way, whereby we have found its diverſity, by drawing, on the ſubjacent table, a ſtraight line through that point; the place of which line will be determined by the one Eye *through* this Chryſtal, and by the other Eye *without the* Chryſtal. For, in the ſame *Figure*, let through the Object A, be drawn upon the Table, a ſtrait line BC. The Eye being in M, that double line H D, and I E, will appear, the *ſpecies's* being caſt on the upper ſurface: And if you attend well, you will obſerve one of the Images, *viz.* the Fixt H D to be congruent to the ſubjacent line B C, whil'ſt the other, namely the Moveable E I, tendeth towards R. But, if afterwards the Eye be poſited in O, the ſame Object, I mean the line B C, will not only be repreſented double by the images K F, and L G; but alſo the Movable Image G L be congruent to the inferiour line B C; while the Fixed F K is not ſo, but tends towards N.

After the Author hath given us theſe Experiments, he undertaketh to determine the *Quantity* of the Refractions in this Double-refracting Body; and haveing firſt given the *Demonſtration* of the Method of Meaſuring the Refraction of *Glaſs*, (omitted by *Des-Cartes* in his *Dioptricks*,) he finds, after ſeveral Tryals, the Angle of Inclination to the Angle of Refraction in this *Iſland*-Chryſtal to be as 5 to 3.

But this Ingenious Perſon doth not ſtop here, but proceeds to *demonſtrate* all the recited Experiments; obſerving firſt, that the Teachers of the *Corpuſcularian* Hypotheſis, which includeth that of *Figures* and *Pores*, could not wiſh for a fitter Body, than this, to aſſert their Doctrine; in regard that it appears, firſt, that this Double-refracting Body hath its Pores according to the *Ductus* of the ſides, and parallel therereto; ſince it may be obſerv'd, that, according to this diſpoſition of the ſides, it is broken, and the parts ſever'd from one another; and that one of the Images, namely the *Moveable*, paſſeth through them. Next, beſides theſe Pores, lying according to the Paralleliſme of the ſides, it hath others, ſuch as Glaſs, Water, and right Chryſtals have, through which the *Fixt* Image is tranſmitted.

But paſſing by theſe, our Author aſſumeth two *Hypotheſes*, as neceſſary to his deſign, not ſo much found out by Ratiocination, as by the above related Experiments. The one is, that there are ſome Lines, by which the Rays paſs through the tranſparent Body un-refracted; which Lines though they have been held to be Perpendicular in Diaphanous Bodies hitherto known, yet this Author requireth not, that they ſhould be always ſuppoſed ſuch, ſince they may perhaps in ſome caſe be not ſuch. The *other* is, that it may be ſuppoſed, that half the light or appearance, diffuſed from the Object, is refracted according to the *Uſual* Refraction; but the other half according to the *Un-uſual* Refraction; or, which is all one, that the Uſual and Un-uſual Refraction have the ſame power to refract the Rays of the Objects. The former of theſe Suppoſitions he collects from Exper. 14; the latter from Exp. 8. But, how he proceeds in theſe *Deductions*, and the thereon grounded *Demonſtrations*, may be more fully and more plainly ſeen in the above-mentioned *Tract* it ſelf, than can be conveniently deliver'd in this *Epitome*.

An Extract of a Letter from a Learned French Gentleman, concerning a way of making Sea-water ſweet.

MOnſieur *Hauton* hath now declared his ſecret of making Sea water ſweet. It conſiſts *firſt* in a *Precipitation*, made with Oyl of Tartar, which he knows to draw with ſmall charges. *Next*, he *diſtills* the Sea-water; in which work the Furnace taketh up but little room, and is ſo made, that with a very little wood or coal he can diſtill 24 pots of water in a day: For the cooling of which, he hath this new invention, that inſtead of making the *Worm* paſs through a Veſſel full of water (as is the ordinary practiſe,) he maketh it paſs through one hole, made on purpoſe out of the Ship, and to enter in again through another: So that the Water of the Sea performeth the cooling part: By which means he ſaveth the room, which the common *Refrigerium* would take up; as alſo the labour of changing the Water, when the *Worm* hath heated it. But then *thirdly*, he joyns the two precedent Operations, *Filtration*, thereby perfectly to correct the malignity of the Water. This Filtration is made by means of a peculiar Earth, which he mixeth and ſtirrs with the diſtilled water, and at length ſuffers to ſettle at the bottom. *Paris* Febr. 22. 1670.

An Extract of another Letter written by the ſame, concerning two Experiments made for finding another Paſſage *of the* Urine, *beſides the known one; as alſo ſome Circumſtances relating to the precedent Invention of making Sea-water potable.*

HAving been, not long ſince, employed in ſearching after the *Paſſage* of the *Vrine* * in Animals, I made, for that purpoſe, a Dog drink a good quantiry of water, and thereupon cauſed his *Vreters* to be well tyed about, and emptied his bladder. After two hours I found the Bladder empty, and the *Vreters* were not tumid above the Ligature. Being ſurpriſed thereat, I believed, that the cauſe might be the too much cooling of the inward parts, that had all this while been expoſed to the Air; the Section having been made Croſs-wiſe, afrer the ordinary manner. To avoid this inconvenience, I thus reiterated the Experiment upon another Dog; I cauſed a ſmall opening to be made on each ſide, ſufficient to find and to tye the Ureters, and to ſqueeſe the Urine out of the Bladder, by preſſing it with ones hand. This done, I made theſe Openings to be ſow'd up again; and then having made the Dog drink good ſtore of water, I left him for near three hours in the leaſt violent poſture that his Ligatures would permit. Afterwards having open'd both the holes, and the Bladder being preſſed with the hand, there iſſued out of it a pretty quantity of Urine, and the Ureters ſeemed to be a little ſwelled above the Ligature. This Operation was made with great exactneſs; but yet as it is of importance for diſcovering the way of the Urine, I would have repeated it often, if I had not been obliged haſtily to come away from the place where I then was. I am not now at leiſure to try it again; but I exhort you, *Sir*, to engage ſome of your beſt Anatomiſts, among other reſearches to employ themſelves in this Inquiry.

* *What is here more largely related, was briefly intimated in* Num.65.p.2084.

Monſieur *Hauton* maintains, that his diſtill'd Sea-water (whereof I formerly wrote to you the proceſſe) is altogether ſalubrious. He proveth it *firſt* from Experience, it having been given to Men and Beaſts without any ill effect at all upon them. *Secondly*, from Reaſon, grounded on this, that that peculiar Earth, heretofore made mention of, being mixed with the diſtilled Water, blunts the points of the Volatil Spirits of the Salt, and ſerveth them for ſheaths, if I may ſo ſpeak, taking away their force and maligne ſharpneſs, &c. St. *Germain*, October 30. 1670.

A Relation

Of the abundance of Wood, found under ground in Lincolnſhire; *communicated by a Friend, well acquainted with that Country.*

THat Fenny Tract, call'd the *Iſle of Axholme*, lying part in *Lincoln-ſhire* and part in *York-ſhire*, and extending a conſiderable way, hath anciently been a Woody Country, witneſs the abundance of Oak, Firr, and other Trees, of late frequently found in the *Moore*; whereof ſome Oak are five yards in compaſs, and ſixteen yards long; others ſmaller and longer, with good quantities of Akorns near them, lying ſomewhat above three foot in depth, and near their roots, which do ſtill ſtand as they grew, *viz.* in firm Earth below the Moor. The Firrs lye a foot or eighteen Inches deeper, more in number than Oak, and many of them thirty yards long; one of them being, not many years ſince, taken up of *thirty ſix* yards long beſides the top; lying alſo near the root, which ſtood likewiſe as it grew, having been burnt and not cut down, as the Oak had been alſo. The Number of theſe trees is reported by Mr. *Dugdale*, in his Book of *Drayning the Fens in England* (where you will find this whole narrative confirm'd) to be ſo great, that the Inhabitants have, for divers years laſt paſt, taken up many Cart-loads in a year.

As to the firſt time of the overflowing of this Woody level, no Account is given, that I know of, not by the Inquiſitive and Learned Antiquary Mr. *Dugdale* himſelf. He only ſaith, that the depth of the Moor evinceth, that it hath been ſo for divers hundreds of years, ſince *that* could not grow to that thickneſs it is of, in a few Ages. Of the Cauſe thereof he concludeth, that to have been the Muddineſs of the conſtant Tydes, which flowing up *Humber* into *Trent*, left in time ſo much filth, as to obſtruct the Currents of *Idle*, *Done*, and other Rivers, which thence flow'd back and overwhelm'd that flat Country.

A Deſcription
Of the Stone-Quarry near Maeſtrich; *communicated by an Obſerving Perſon, converſant in that Country.*

THere is an excellent Quarry, within Canon-ſhot of *Maeſtrich*, upon the very brink of the River *Maſe*, lying in a Hill, where there are about 25 fathoms of Rock and Earth over head; the length of the Hill being of ſome miles extending along the River towards *Liege*, ſcituate on the ſame River; and near *Maeſtrich* having in breadth, ſome ½ or ¾ of a mile, but ſome more, farther off. This Quarry hath one Entry towards the River, where Carts can paſs with great eaſe, and unload the Stones upon the brink of the River, the Quarry within lying parallel to the Horizon or level, (which is a great advantage) and elevated but very little above the River.

This ſame Quarry, which hath, well nigh, undermin'd the whole Hill, affords one of the moſt ſurprizing Proſpects, when well lighted with many Torches, that one can imagine. For, there are thouſands of ſquare Pillars in large level Walks, and thoſe almoſt every where, above 20, and in ſome places, many more foot high, and all wrought with ſo much neatneſs and regularity, that one would think, it had been made rather with curious Workmanſhip for an under-ground Pallace, than that thoſe Pillars and Galleries were made by Quarriers, that did it only for getting Stone to build above-ground.

This Quarry ſerveth the People, that live thereabout, for a kind of impregnable Retreat, when Armies march that way. For, being acquainted with all the ways in it, they carry into it whatſoever they would have ſafe, as well their Horſe and Cattel, as their Moveable furniture, till the danger be over;

there being ſo vaſt a deal of room, that 40000 People may ſhelter themſelves in it. And he that would attempt to ſeek them out in this vaſt Wilderneſs of Walks and Pillars, without an expert Guide, would not only be in hazard of looſing his way, but of being knock't in the head at the Corner of every Pillar, where people lurking in the dark with their Carabins and Fowling pieces, would have fair opportunity to ſhoot them by the light of their own Torches.

In this vaſt *Grotto* 'tis remarkable, that there is but little Rubbiſh: which ſhews both the goodneſs of the Stone, and the carefulneſs of the Workmen. And in divers places there are little Pools of Water, perhaps made on purpoſe for Beaſts to drink, and to ſerve for other uſes in time of need: For in no place almoſt are there any Droppings to be ſeen; nor are the Walks at all wet under-foot; only it ſeems, that Rain gets in by the *Air-ſhafts*, which, for ſaving of labour, and perhaps too, to make theſe Pools, are let down from ſuch places commonly, as are the Pools thereabout; and ſo the Rain, that falls on the higher grounds, does eaſily find the way thither.

An Account of ſome Books.

I. *TRACTS written by the Honourable* Robert Boyle, *of a Diſcovery of the* Admirable *RAREFACTION of the AIR (even without Heat:) New Obſervations about the DURATION of the SPRING of the AIR: New Experiments touching the CONDENSATION of the* Air *by meer COLD; and its COMPRESSION without Mechanical Engins: And the admirably DIFFERING EXTENSION of the ſame Quantity of* Air *rarifyed and compreſſed.* London, *for* H. Herringman, 1670. *in* 4°.

THE main drift of theſe Excellent *Tracts* is, to invite the Curious to obſerve the ſtupendious Mutability of the *Air*, as to Rarity and Denſity, whereby the ſame Quantity of Air, being ſometimes compreſs'd, ſometimes dilated, may change its Dimenſions to a degree, that ſeems almoſt to tranſcend the power of Nature and Art, and might be look't upon as incredible, if it were abruptly and nakedly propoſed, or by a perſon of only *common* ſkill in theſe matters.

It will then appear by the Experiments and Calculation, made by our Noble Author, that, according to the leaſt Eſtimate of any recited in them, the Extenſion of the ſame Quantity of Air, is as 1. to 2744, or thereabouts: And if, inſtead of the moderateſt, there be taken the greateſt Expanſion of the Air; being as about 13000 to 1, when the *uncompreſt* Air was highly rarify'd, that number being multiplyed by 40, becauſe of the great Compreſſion of the Air, effected by Cold (as appears in the Third of theſe Tracts,) will amount to 520000, for the number of times, by which the Air at one time exceeds the ſame portion of Air at another time: Which is an Expanſion ſo great, that it will eaſily keep the Reader from thinking the Title of this *Diſcourſe*, where the Rarefaction of the Air is call'd *Admirable*, immodeſt.

It will alſo appear by theſe Tracts, that the Air may by the Intervention of Art and Inſtruments be much more expanded, than it has yet been found to be by the bare application of External Heat, though it were that of an Intenſe Fire it ſelf.

The Natural Philoſopher will doubtleſs, upon the reading of this ſtrange Expanſion of the Air, be excited to conſider, when he ſhall look on one of our Author's well exhauſted Receivers, How ſmall a proportion the Common Aereal particles, which are very ſparingly diſpers'd there, bear to the whole Cavity of the Veſſel, which, before it was exhauſted, was thought to be repleniſh't with Air alone. Certainly both the *Carteſians* and *Epicureans* will find themſelves highly concern'd in this matter. The *former* will endeavor thereby to eſtabliſh the neceſſity of their *Materia ſubtilis*, to maintain the *Plenitude* of the World, and the Circle they attribute to Moving Bodies. The *latter* will think, they have cauſe here to triumph, as believing to have met with a more illuſtrious Inſtance, than ever, of their *Vacuum Coacervatum* within the World; ſince here is an impenetrable Veſſel, out of which 'tis manifeſt, that an almoſt incredible proportion of Aerial ſubſtance hath been made to iſſue; whereas 'tis no ways manifeſt to any of our ſenſes, that any other Body hath got in to ſucceed in its room.

II. *ELEMENTA GEOMETRIÆ PLANÆ.* *Authore* Ægidio Franciſco *de Gottignies Bruxellenſi, Soc. Jeſu in Collegio Romano Matheſeos Profeſſore,* Romæ 1669. in 12.

THis Author, in a *Monitum* to the Students of Geometry, intimates, that he hath read Mathematicks more than 7 years at *Rome*; that it hath been his cuſtome to adviſe his Scholars *firſt* to read over the Definitions, the Titles of Propoſitions, and to exerciſe themſelves in the Conſtruction of Problems, without being ſolicitous of the truth of the Propoſitions or Conſtructions, until they become familiar; and after they are ſomewhat converſant with the Geometrick Aſſertions and Phraſes, then to doubt of their truth as much as they pleaſe, and ſtudy their Demonſtration. The ſame, in the Proeme thinking it convenient to begin with Quantity, treats of it abſtractly, as void of ſuch affections and modes as are congruent thereto.

1. In his firſt Chapter he giveth Definitions, Poſtulates, and Axiomes.

2. In the ſecond, becauſe one quantity in relation to another is ſaid to have a *Ratio* or *Proportion*, he treats of *Ratio's*, and delivers the doctrine of the fifth Book of *Euclid*; to which are annexed 7 queſtions about *Geometrical Proportions* with their Solutions, clearing up the debates, that through the miſtakes of ſome late Authors have riſen about *Ratio's*.

3. He treats of Angles, and of the affections of Angles in plain Right-lined Figures. And at the end of this *Chapter* he ſtates the queſtion, Whether an Angle be a *Quantity* ſhewing, that *Clavius* affirms *all Angles* to be quantities; *Peletarius* denyes the *Angle* of *Contact* to be a quantity; *Tacquet* condemns both, denying *any Angle* to be a quantity, to whom our Author aſſents, and on this Hypotheſis removeth 5 Paradoxes, that are natural to the other aſſertion. And whereas a late Writer alledgeth, that it may be pleaded to be the opinion of the Antients, he ſaith, that among the Learned moderns, it is now refuted, herein ſiding with *Gregory of St. Vincent*, *Aynſcomb*, *Tacquet*, and *Dr. Wallis*.

4. He treats of Rectangles.

5. Of Triangles and Right-lined Figures.

6. Of Circles, where he delivers the Doctrine of the third Book of *Euclid*; and, imitating *Archimedes*, enlargeth this *Chapter* with other propertys, which he had firſt ſhewn to be congruent to Right-lined Figures.

7. He treats of Problemes, by which a Preparation is made to paſs from Speculation to Uſe and Practice.

The Author having thus altered *Euclid*'s order, giveth an *Index*, to ſhew where the Propoſitions of the 1, 2, 3, 5 and *6th.* Book of *Euclid* are to be found in theſe Elements.

He hath paſſed over all the Propoſitions of the 4*th.* Book of *Euclid*, as ſuperfluous in his method: In that Book, 'tis known, that *Euclid* teacheth, How to Inſcribe or Circumſcribe *ſome*, but not *any* Regular Figures about a Circle: Of this he treats at the end of the 7*th.* Chapter. This Doctrine is either neceſſary for Practice, as in *Fortification*; or in order to the Conſtruction of the *Canon* of *Sines*. He intends to treat of *Trigonometry* and *Practical Geometry* elſewhere, ſaying in his Dedication;

Euclidem ex novo adornare ſtudui, brevi tamen ſcriptione concinnatum, ut eſſet opportunior. Ex quo tanquam ex fundamento pendet reliqua mearum doctrina tractationum, quas prælo paratas me habere probè noſti. As to his method of Demonſtration, he ſaith, *Demonſtrationes vix alias pono, quàm affirmativas, ut diſcentibus conſtet, ea quæ proponuntur non tantùm vera eſſe, ſed etiam cur vera ſint: in Euclide non pauca per negativas demonſtrationes probantur, vel in his probandis negativè tantum probata aſſumuntur; & An rectè omnia, nonnulli controvertunt.*

III. *SYNOPSIS GEOMETRICA*; *cum Tribus Opuſculis, De LINEA SINUUM & CYCLOIDE; De MAXIMIS & MINIMIS, Centuria; Et SYNOPSIS GEOMETRIÆ PLANÆ, Auth.*Honor. Fabry *S. Jeſu.* Lugduni Galliarum 1669. in 12°.

THis Author in this *Geometrical Synopſis* hath endeavour'd, as M. *Gottignies*, (juſt now taken notice of,) promiſeth to do in his *New Euclid*, to render *Geometry* clearer and eaſier by delivering ſuch Demonſtrations, as prove the thing in hand by *direct* and *intrinſick* Principles, not ſuch as are indirect, and leading *ad abſurdum & impoſſibile*, whereby 'tis only concluded, that the thing cannot be falſe, but not ſhewn, why it is and muſt be true. In reference to which, he conſiders, that, whereas *Geo-*

metry conſiſts in demonſtrating the proprieties of *Quantity*, there is no ſuch propriety, but it belongs to it by ſome genuine and intrinſick principle, eaſily to be found out by the *Analyſis* or *Geneſis* of Quantity. By which way he Judgeth, that *Geometry* may be exceedingly contracted, foraſmuch as very many things, ſeparately demonſtrated in the received way, may then be evinced joyntly by one plain and eaſy Demonſtration; conſidering that, where the ſame propriety belongs to various quantities and figures from the ſame intrinſick Principle, whether they be Plain, or Solid, or Right lined, or Curve, or Mixt; nothing hinders, but *that* propriety may be Demonſtrated of them all by one onely Demonſtration.

And hence this Author is inclinable to lay aſide thoſe many Diviſions of Geometry, as are made by Authors, *viz.* into *Trigonometry*, *Planometry* and *Stereometry*; and peculiar and prolixe Treatiſes of *Conical Sections*; of the *Sphære* and *Cylinder*; of *Lines* of divers kinds; of *Plain* and *Sphærical Triangles*; of a *Solid Angle*; of *Proportions* and *Proportionalities*, &c: eſteeming, that a more convenient Diviſion will ſerve his Deſign; whence he compriſeth this whole *Synopſis* in two parts.

The *Firſt* treats of the *Elements* for Beginners, and contains 6 parts: In the firſt whereof are deliver'd the Definitions and Explications of Terms, the Axioms, and *Poſtulata*. In the ſecond, are explain'd the *Geneſis* and *Analyſis* of Figures, and their different *Claſſes*. In the third, are demonſtrated the Elements of *Lines* and *Angles*. In the fourth, is treated of *Ratio's* and *Proportions*. In the fifth, are conſidered the *Products* of the *Segments* of a *Line*, multiplyed into one another. In the ſixth, are handled the remaining Elements.

In the *Other*, he proceeds to the Demonſtration of higher and abſtruſer things; and this part he divideth into ſeveral *Claſſes*, each of which contains all its *homogeneal* figures, Rightlin'd or Curve, Solid or not Solid; there being ſo many ſeveral *Ranks*, as there are different ways of their Generation. Theſe *Claſſes* are here diſtributed into two ſorts, the *one* contains thoſe Figures, whoſe Generating quantity is drawn either into the whole Altitude, or into its Rational or Commenſurable Segment, for the Æquation of the Figure; the *other* is of thoſe, whoſe Generating quantity can only be drawn into an Irrational Line, for Æquation. But he adds, that it often falls out, that one and the ſame Figure belongs to ſeveral *Claſſes*, in regard that it may be reſolved into divers Elements, or have more than one *Genitrix*, and therefore, according to the variety of the *Genitrix*, may be diverſly generated. And this, he eſteems, doth very much commend his Method, in regard that there is the ſame Æquation of the ſame Figure, whether it be demonſtrated in this or that Claſſis by this Intrinſick Principle.

Mean time this Author denyeth not, that this kind of *direct* Method was before him deliver'd and publiſht by *Bonaventura Cavalerius*, but adds, that it was done with ſuch difficulties and obſcurities, as deterred young Students from it; which in this *Synopſis* are ſaid to be avoided, or removed.

As to the Three *Opuſcula*, adjoyned to the *Synopſis*, the Author affirms of the *Firſt*, that it was publiſh't *Eleven years* ſince, but uncorrectedly; now Re-printed more carefully, and with a deſign, to give a Specimen of his new Method in that abſtruſe Argument; adding withal, that, for ought he knows, he is the firſt that hath written of this Subject; only he had ſeen ſome few things concerning the *Cycloid* in *Torricellius*, in that *Appendix*, which he ſubjoyn'd to the Problem of the *Dimenſion* of the *Parabola*, where he very well demonſtrates, that the Space contained by the *Cycloid* and *Baſis*, is Triplicate to the Generating Circle. But our Author affirms to have here added many new Demonſtrations, alledging, that *Torricellius* in the ſaid *Appendix* hath demonſtrated nothing elſe, but that one thing juſt now recited. And though the ſame in his *Firſt Book De Motu Gravium* doth *propoſe* many excellent things of the *Cycloid*, yet our Author obſerveth, that he hath *demonſtrated* none of thoſe.

Concerning the *ſecond* Opuſcle, *viz.* the Century of his Propoſitions *De Maximis & Minimis*, he affirms, to have written them, for his divertiſement, many years ago. And the *third*, which is a *Short piece of Trigonometry*, he ſaith to have haſtily Compoſed at the ſollicitation of an Ingenious Friend, to ſerve Mathematical Beginners.

IV. *DIALOGI PHYSICI, quorum* Primus *de Lumine*; Secundus & Tertius *De VI PERCUSSIONIS & MOTU*; Quartus *De HUMORIS ELEVATIONE per CANALICULUM*;

Quintus

Quintus & Sextus *De Variis Selectis. Auth* Honor. Fabry, *S. Jeſu*, Lugduni Galliarum, 1669. in 8°.

THis Learn'd Jeſuit in thoſe *Dialogues* writeth againſt *Grimaldi*, *Alphonſus Borelli*, and *Montanari*, who in divers things differ from what he hath written: Againſt the *firſt*, concerning *Light*, and that great controverted point, *Whether it be a Body?* And whether *Reflection*, and *Refraction* prove it to be ſuch? *&c.* Againſt the *ſecond* he writeth, about *Motion* and *Percuſſion*, where many things are diſcuſſed; as, Whether motion be *produced*, or *traduced?* Whether the *impetus* of the leaſt Body may move the greateſt Body? Whether the Force of *Percuſſion* be a certain action of Compreſſion in the Impellent Body? What are the Laws of two *Projected* Bodies; equal, or unequal; of equal, or unequal velocity? Whether the Times of the Vibrations of different *Pendulums* are in a ſubduplicate proportion of their Lengths? Whether a Body impelled, being reflected by a Springy and Compreſſed Body, reſtoring it ſelf, be moved and carried back with that *Impetus* only, which it received from the ſame? Whether a Body *Horizontally* projected will at the ſame time come to the ground, as if it had of it ſelf fallen down *Perpendicularly?* Why Bricks are broken by the percuſſions of an Hammer, though they remain whole under the weight of a vaſt and bulky Body? And why an Hatchet cleaveth Wood, whereas a very heavy weight laid on an Hatchet fixed in Wood, doth not? What is the Principle of the Motion of Reſtitution? And many more. Againſt the *third* he writeth, about the *Aſcent of Liquors in ſlender Tubes*; to wit, whether that Riſing proceeds from the Gravitation of the Air, or from its Compreſſion only, preſcinded from its weight? Whether Liquors do riſe equally high, in longer and ſhorter Tubes, but of equal bore? *&c.*

The *Two laſt* Dialogues contain *Miſcellanies:* As, of the *Impetus* innate in Bodies, aſſigned them by Nature to attain their reſpective Ends; of the Gravitation of the Air and its preſſure downwards, to make Vapors aſcend; of the Variety of Motion in Heavier and Lighter Balls moved on Longer or Shorter, thicker or ſlenderer, ſtrings; of new Mechanical Powers; of an Hypotheſis for ſolving the *Phænomena* of the *Tydes* by the Preſſure of the Atmoſphere, importing, that the Tydes do vary according to the inequality, or the various Circles of the Air's preſſure, and the ſeveral Tracts of thoſe Circles, in reſpect of their Scite and Extent; ſo that if all the Circles of that preſſure of the Air were free, that is, if the water did cover the whole Surface of the Earth, it would riſe much higher in the Tydes; (See pag. 406,407:) Beſides, of a Queſtion, Whether in a Ship moved, all the motions of the people carried in it will be made after the ſame manner, as if made in a Ship not moved; Of the 7 Rules of Motion deliver'd by *M. Hugens*, with ſome conſiderations thereon, p. 411; Of the great Compreſſion of the Air, in reference to what *Mr. Boyle* hath publiſh't on that Subject, p. 436; Of the Controverſy, Whether the Mercury in the *Torricell.* Experiment be ſuſtain'd by the external Air, or by a Tenſe matter within; Of the cauſe of the *Glaſs-drops* ſhiver'd in ſmall pieces by breaking off the tail of them, p. 467; Of *Electricity*, p. 475, &c. But whether our Author have the better of thoſe, againſt whom he writes, I ſhall not take upon me to Judge, but leave it to the Reader to think as he ſhall ſee cauſe.

V. *ANTONII MOLINETTI, Phil. & Med. Veneti*, &c. *DISSERTATIONES ANATOMICÆ & PATHOLOGICÆ de* Senſibus *& eorum Organis.* Patavii, 1669. in 4°.

IN this Learned Treatiſe of the *Senſes*, the Author begins from the conſideration of the Touch, diſcourſing of the genuin Organ thereof, which he maketh to be the ſoft ſubſtance of the Nerve only.

Next, he treats of the *Sight* and its Organ; where he largely diſcuſſeth the old Controverſy of the manner how Viſion is made, whether by the Reception of the Species or viſible rays of the Object, or by the Emiſſion of the Spirits of the Eye; maintaining the former, and refuting the latter. Then he proceedeth; 1. To ſpeak of the nature of *Light* and *Colours*, eſteeming the diſtinction of Colours into *Real* and *Apparent* to be puerile. 2. To treat of the Three Refractions of the Luminous rays made in the Eye, by the ſeveral humors thereof. 3. To aſſign the different apertures of the Pupill according to the diſtance of the object, and the degrees of its illumination; as alſo the reſpective offices of the Chryſtallin, Vitreous, and Aqueous humors; and the reaſon of their poſition, and configuration,

guration, *&c.* 4. To give the Hiſtory of the *Tunicles* and *Muſcles* of the Eye, aſſerting the *Retina* to be the formal organ of Viſion; and Seven *Muſcles* to perform all the motions therein; and obſerving the curious ſtructure and *apparatus* in all. 5. To diſcourſe of the various Diſtempers of Eyes, and to obſerve, that there is ſcarce any particle of that organ, not ſubject to ſome peculiar diſtemper; which he very learnedly and accurately ſpecifies and enlarges upon.

Thirdly, he treats of *Hearing* and its Organ having premiſed, that the difference of the ſeveral Senſes conſiſts only in the different *apparatus*, by which all the ſenſible Objects are received in one and the ſame formal organ, of the ſame kind; as alſo, what Analogy there is in the ſtructure of the Eye and Ear; the *Cornea* of the one anſwering the *Membran* of the other; the Water within the *Cornea*, to the Air within the *Tympanum*; the Ciliar ligaments of the Eye, relaxing or ſtreightning the *Pupill*, to the *Stapes* of the Ear, capable to be eaſily moved inward, and a little outward. Now of this Senſe of Hearing he obſerveth, 1. The Air-reflecting organ (anſwerable to the Refractive organ in the Eye) and remarketh the admirableneſs of its fabrick; as alſo how exactly every vibration of the Air, made upon the *Drum* by the outward Air, is by the Labyrinth of the Eye diſtinguiſh't from one another. 2. The manner, how *Hearing* is performed; where occur divers un-common Obſervations about the *Malleus*, *Incus*, and *Stapes*; and the three *Holes* in the *Drum*; as alſo of the paſſage, by which the cavity of the Drum hath a conſent with the Palat, *&c.* 3. The many diſtempers of this Organ, very accurately deſcribed.

Fourthly, concerning the Senſe of *Smelling*, he 1. Taketh notice, that *Veſalius* was the firſt, that rightly obſerved the *Olfactory* Nerves. 2. He obſerveth the Analogy of this Senſe to thoſe of Seeing and Hearing. 3. Giveth the reaſon, why Doggs, Horſes, and ſome other Animals excel the reſt in the ſtrength of Smelling. 3. Affirms, that moiſture falls into the Noſe, not by the Holes of the *Os Ethmoides*, but by thoſe that are in the inward corners of the Eyes. 4. The *Diſeaſes* of this Senſe; where the Author taketh occaſion to commend the Art of *Taliacotius* in reſtoring loſt Noſes, and to confirm the truth of that Practice, performed by his own Father, *Fifthly*, touching the *Taſt*, he 1. Maketh the *Tongue* the Organ of it, as it is made up of ſuch a kind of Porous Fleſh, cover'd with ſuch a coat, and very plentifully enterwoven with ſuch nerves; furniſh't with a fine *Saliva*, which being mixed with the meat and drink, ſinks it into the nerves through the pores of the Coat, and ſo gives different kinds of Taſt. 2. Compareth this Senſe with all the former, by obſerving the Analogy betwixt them. 3. Aſſigneth the difference between Taſt and ſimple Touch. 4. Enumerateth the Affections of the Tongue, and inſiſts eſpecially upon the *Convulſion* and *Palſy*, which it is ſubject to.

Having diſpatched his Diſſertation about the *Five Senſes*, he proceeds to the conſideration of the *Brain*, whereof he 1. Explains the admirable ſtructure, connexion and dependency of its parts. 2. Shews the difference of the *Animals* Spirits from the *Vital*; which he eſteems to be only this, That the Animal Spirits are Vital Spirits highly rectified, refined and perfected in and by the Brain, for Senſation. 3. Lays open the origine of the *Nerves*, proceeding from that part of the Brain, call'd *Pons Cerebri*, which he makes to be nothing elſe but a *Congeries* or Heap of innumerable Filaments, divaricated out of the Solider ſubſtance of the Brain; whence all the *Nerves* (many of thoſe threds being joyned together) take their riſe; which in their iſſue out of the Bones, either thoſe of the Skull or the *Vertebra's*, are inveveſted by both Membrans, which contain them as well, as they do the Brain it ſelf. 4. Declares, that in the ſaid *Pons Cerebri*, from whence all the *Nerves* proceed, is tranſacted the *Common Senſation*; confidently affirming, that whatever motions are made in the Organs of Senſe by the Spirits that are in the Nerves, they muſt needs be conveyed into the Principle of the Nerves (which, in his judgment, is the *Pons*;) and that performed in a moment of time, by reaſon of the continuity of the Spirits from the Senſory's to the ſaid common Source. 5. Diſtinguiſheth the Operations of the *Common Senſe* from thoſe of the *Phancy*, and *Memory*; and withal teacheth, how the Rational Soul differenceth the Apprehenſions of things from thoſe made by Brutes. 6. Determins not, whether, for the *Memory*, the *veſtigia* of things are impreſſed in the Brain; or whether the ſubſtance of the Brain be ſo framed, that according to the different agitation of the Spirits it may be contracted or dilated; or elſe, whether the Pores or minute Paſſages between the medullar Filaments be open'd, or ſhut, and that more or leſs; or laſtly, whether it be, that the Spirits are variouſly diſpoſed, whilſt the *Medulla* of the Brain remains in the ſame ſtate? 7. Diſcourſeth of *Sleep* and *Waking*; where he very curiouſly obſerveth, *firſt*, How far there is in Sleep a Ceſſation of Senſe and Motion; and how *Night-walkings* and *Reſpiration*, (two very ſtrong Motions) are performed in Sleep: *Secondly*, What is the immediate cauſe of that Ceſſation, *viz.* a ſcanty and alter'd influx of the Spirits into the Organs of outward Senſe. 8. Aſcribeth the exact knowledge of the *Medulla Spinalis* to that excellent *Engliſh* Phyſitian and Anatomiſt Dr. *Willis*. 9. Explains the order in which the ſeveral Combinations of the *Nerves* do proceed, out of the Medullar Maſs of the Brain, into and through the whole Body. 10. Concludeth the whole with an Explication of the *Affections* and *Diſeaſes* of the Brain; and ſhews, *firſt*, How the various *Head-aches* are cauſed by the various qualities of the parts that compoſe the Bloud, which being either *bilious*, *ſulphureous*, *ſalin*, *aqueous*, or *terreſtrial*, do accordingly cauſe lacerating, pricking, vellicating, or heavy pains: *Secondly*, How the *Dropſy* of the Brain is cauſed by the copious ſeroſities gather'd between the Membrans of it. *Thirdly*, How *Ulcers*, *Obſtructions*, and *Inflammations* are produced. *Fourthly*, How thoſe many *Perturbations* and *Symptoms* are occaſioned in the Brain, as *Sadneſs*, *Fear*, *Sleepineſs*, *Madneſs*, *Forgetfulneſs*; Epilepſy's, Apoplexy's, among which two laſt he finds this difference, that an *Epilepſy* is not neceſſarily preceeded by any Obſtruction; an irritation and an offenſive afflux to the Senſible parts, being able to produce it alone; whereas an *Apoplexy* never comes without an Obſtruction of the Spirits. *Fifthly*, How *Palſy's* are cauſed, *viz.* by an influx of impure Spirits from the Origine of the Nerves into the beginnings of the ſame. *Sixthly*, How *Overmuch Watching* is occaſioned, namely by over-hot Spirits; as an *Un-natural Sleep* is produced by thick, torpid and cold vapors, intermingled with the Spirits, *&c.*

Errata.

In Numb. 65. *p.* 2014. *l.* 17. *del.* firſt, *and read,* were ſtarted. *Beſides, the Reader is deſired, not to be offended at the overſight of the Printer, who in this ſame Tract of* N. 65, *when he ſhould have numbred page* 2107, *did print* 2007; *whereby ſome confuſion would ariſe in the* Index *that is to follow, if therein the Publiſher did not intend to prevent it in ſome meaſure by quoting as well the* Number *of theſe Tracts, as the* page. *In this* Numb. 67. *p.* 2040. *l.* 17. *del.* Farewell.

LONDON,

Printed for John Martyn, *Printer to the* Royal Society.

PHILOSOPHICAL TRANSACTIONS.

Februar. 20. 16$\frac{70}{71}$.

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Extract of a Letter, written by Mr. John Wray *to the Publiſher* January 13. 1670. *Concerning ſome un-common Obſervations and Experiments made with an Acid Juyce to be found in* Ants.

SIR, What I now ſend you concerning the *Juyce* of *Piſmires*, I received not long ſince from Dr. *Hulſe* and Mr. *Samuel Fiſher*. The Obſervations ſent me by *Mr. Hulſe* the tenth of

Auguſt laſt paſt,are theſe. Lately (ſaith he) conſulting *Langhams Garden of Health*, I met with this paſſage : *Caſt the flowers of* Cichory *among an heap of Ants, and they will ſoon become as red as bloud.* Note,that *Langham* was not the firſt,that made or publiſhed this Obſervation : I find it deliver'd by *Hieronymus Tragus Hiſt. Stirp. l.* 1. *c.* 91. *Naturæ miraculum in hoc flore obſervare licet ; ſiquidem cumulo Formicarum abditus, Cæruleum colorem in rubrum mutat, ac ſi terrore illarum erubeſceret.* And before him, it was taken notice of by *Otho Brunſfelſius*, as *Johannes Bauhinus* obſerves. I preſently got ſome Cichory flowers, and made the Experiment, and find it to be true what he ſaith; only he takes no notice of the manner,how the flowers come to be ſtain'd : which therefore take as followes. Bare an Ant-hill with a ſtick, and then caſt the flowers upon it, and you ſhall ſee the Ants creep very thick over them. Now as they creep, they let fall a drop of liquor from them, and where that chanceth to light, there you ſhall have in a moment a large red ſtain. Sometimes they will be a pretty while before they diſcolour them, and at other times they will do it ſuddenly. At the firſt I gueſſed, that being vext by ſtirring their hill, they might thruſt their ſtings into the flowers, and thorow them convey that ſharp liquor : But by bruiſing them, and rubbing the expreſſed juyce againſt the flowers, I find they will be equally ſtained. 'Tis a thing well known, that Ants, if they get into peoples clothes, and ſo to their skin, will cauſe a ſmart and tingling, as if they were netled ; which I conceive is done by letting fall the fore-mentioned corroſive liquor, rather than by ſtinging.

To what ſort of liquor to refer this Juyce, I know not. I dropt *Spirit of Salt*, and *Oyl of Sulphur* upon the Flowers, but they did not cauſe them to change colour. * I likewiſe put *Salt of Tartar* upon them, and dropt thereon a little *Spirit of Salt*, which cauſed a ſufficient fermentation, but prevailed not to change the colour of the flowers in the leaſt.

* *See the Poſtſcript of this Letter.*

This Obſervation holds true not only in *Cichory-flowers*,and, I ſuppoſe, all others of a *Blew* colour. It were worth the while to try,Whether that ſharp liquor, which *Mr. Hook* ſaith is in the ſtings of Bees, if it may be got out by thruſting them into the leaves of Flowers, will not cauſe a ſtain. *So far the Doctor.*

Upon reading theſe paſſages, I called to mind an Experiment, which ſome years ſince *Mr. Samuel Fiſher* of *Sheffield* had made me acquainted with, *viz.* If with a ſtaff or other inſtrument you ſtir an heap of Ants, (eſpecially *Horſe-Ants*,) ſo as to anger them, they will let fall thereon a liquor, which if you preſently ſmell to, will twinge the Noſe like newly diſtilled *Spirit of Vitriol.* Conſidering this, and likewiſe that a few drops of the Oil or *Spirit of Vitriol* will ſoon turn the blewiſh *Syrup of Violets* into a bright red; and, as I am credibly informed, the juyces and tinctures of any other flowers or fruits of that or the like colour, I was eaſily induced to think, that this juyce of Piſmires might be of the ſame nature with the Oyl of Vitriol, and other Acid Spirits, (which have in the fore-mentioned reſpects the ſame effects with that Oyl:) And thereupon I ſent to inquire of *Mr. Fiſher*, what Trials he had made of it, who return'd me this following account.

A weak Spirit of Piſmires will turn Borage flowers red in an inſtant: Vinegar, a little heated, will do the like. Piſmires diſtilled by themſelves, or with water, yield a Spirit like Spirit of Vinegar, or rather like the Spirit of *Viride æris.* Lead put into this Spirit, or fair water, with the Animals themſelves being alive, maketh a good *Saccharum Saturni:* Iron put into the Spirit, affords an Aſtringent tincture, and by repetition a *Crocus Martis.* Take *Saccharum Saturni*, thus made, and diſtil it, and it will afford the ſame Acid Spirit again, which the *Saccharum Saturni* made with Vinegar will not do, but returns an inflammable Oyl with water, and nothing that is Acid. *Saccharum Saturni* made with *Viride æris*, doth the ſame (in this reſpect) with that made with Spirit of Piſmires.

When you put the Animals into water, you muſt ſtir them to make them angry, and then they will ſpirt out their acid juyce. No Animal that ever we diſtilled (he ſpeaks of his Brother and himſelf) except this, yields an *Acid* Spirit, but conſtantly an *Urinous*; and yet we have diſtilled many, both Fleſh, Fiſh, and Inſects.

Hitherto Mr. Fiſher, who deſires to be inform'd, whether any ingenious perſon, converſant in theſe inquiries, hath either himſelf found out, or heard of any other *animal*, that by diſtillation or otherwiſe yields an Acid ſpirit. For my part, I know of none; but if any do, they are probably the *favificous* and *gregarious* kind, and generally ſuch as are furniſh'd with ſtings; of which weapon Piſmires are not unprovided. Indeed it ſeems ſtrange, that Nature ſhould prepare and ſeparate in the Body of this Inſect without any ſenſible heat, and that in good quantity, conſidering the bulk of the *animal*, a liquor the ſame for kind with thoſe Acid Spirits, which are by Art extracted out of ſome Minerals not without great force of Fire.

I doubt not but this liquor may be of ſingular uſe in Medicine. *Mr. Fiſher* hath aſſured me, that himſelf hath made trial thereof in ſome diſeaſes with very good ſucceſs.

Poſtſcript.

WHereas in the former account there is a paſſage liable to exception and miſtake, *viz. Spirit of Salt and Oyl of Sulphur, drop'd upon Cichory-flowers, did not cauſe them to change colour*; for the clearing thereof you may pleaſe to take notice, that it is to be underſtood of the flowers entire and unbruiſed: For any Blew flowers being a little bruiſed, and then a drop of Spirit of Salt or any other Acid Spirit let fall thereon, will turn inſtantly red. The reaſon is obvious; for that the leaves of the Flowers (as all the other parts of the plant) being inveſted with a skin or Membrane, the liquor dropp'd thereon cannot eaſily penetrate it, and ſo commix it ſelf with the interiour juyce or pulp. Hence it is, that if theſe flowers be put into cold Vinegar, eſpecially if the weather be cool, they will not change colour for a conſiderable time; but if you heat the Vinegar, they will change immediately.

Whether the Ants do only drop this Tinging liquor upon the ſurface of the flowers, or thruſting their ſtings into the body of the flower, do by them convey it immediately into the interior included Juyce, we cannot yet determine, but refer to future obſervation, when the time of the year will afford us flowers.

Extract

Extract of a Letter written by Mr. Martin Liſter *to the Publiſher,* Jannuar. 25. 16$\frac{70}{71}$, *relating partly to the ſame Argument with that of the former Letter, and directing to another Inſect, that is like to yield an Acid liquor ; partly to the* Bleeding *of the* Sycamore.

SIR, Concerning the Acid liquor of Piſmires , I have very lately received from Mr. *Wray* the Account (I ſuppoſe you have it alſo by this time,) that was ſent him from Mr. *Fiſher* and Mr. *Jeſſop* ; wherein theſe two laſt Gentlemen make this further Inquiry , Whether there be any other Inſect, or Animal, Fleſh or Fiſh, that will afford an Acid Juyce ; they having with great induſtry tried many *ſpecies* amongſt Inſects, and other Animals, without lighting on the like Acid liquor. I am of the mind, there are ; and a ready way to find ſuch out, may be, that having obſerved, that a Piſmire bruiſed and ſmelt to, emits a ſtrange fiery and piercing ſavour, like the leaf of the Herb, by *Botaniſts* called *Flammula,* broken at one's noſtrils ; by this means I have, ſince *Mr. Wray* put the queſtion to me, found an Inſect, which I ſuſpect, may yield an Acid liquor as well as the Piſmire ; and that is the *Long and Round-bodied read-coloured Julus,* diſtinguiſhed from all other *Multipeds,* in that their innumerable legs are as ſmall as hair , and white, and in going they are moved like waves ; not rare amongſt drier rubbiſh ; no *Scolopendra,* ours being an harmleſs inſect, and that armed with dangerous *forcipes.* The body of this *Julus* being bruiſed ſtrikes the noſtrils exceeding fiercely ; but I have not yet had an opportunity to furniſh my ſelf with any quantity of them for farther trials. The Change of Colours in Flowers, *&c.* is a ſubject I have a little conſidered, and you ſhall have my thoughts and Experiments about it more at leiſure.

As to the *Bleeding of the Sycamore* ; the laſt year I winter'd at *Nottingham,* where I pierced a Sycamore about the beginning of *November* ; the turgeſcence of the Buds inviting me thereto , and ſome hopes of improving the notion of Winter-bleedings, ſo happily diſcover'd by *Mr. Willoughby* and *Mr. Wray.* This ſucceeded ſo well with me, that I did afterwards engage my ſelf in keeping a *Journal* throughout the whole Winter; from which Journal, I think, I may note; 1. That the wounded Sycamores never bled, neither in *November*, nor *December*, nor *January*, nor *February*, nor *March*, (which yet they did above 40. ſeveral times, that is, totally ceaſing and then beginning anew,) unleſs there *preceded* a ſenſible and viſible Froſt; for *I* had no other way of recording the temper of the Air. 2. That the Froſt did not always ſet a bleeding the wounds, they found made before they came, though ſometimes they did; but upon their breaking up, or very much relenting, the wounds either made in that inſtant ~~of time~~, or made many months before, did never fail to bleed more or leſs. 3. That particularly upon the breaking up of the two great and long Froſts (the firſt of which hapn'd that year in that Country to be on the third of *January*; the ſecond, about the 12th, 13th and 14th of *February*,) all the wounds ran moſt plentifully: ſo that ſuch times may be look'd upon as the moſt proper ſeaſon of gathering great quantities of Juyce from this Tree. Removing into *Craven* the latter end of *March*, and thence to *London*, my Journal was diſcontinued; I had yet, upon my return from *London* into *Craven*, ſome leiſure to proſecute it. Thoſe, I there wounded the latter end of *May*, did did not bleed neither the remaining part of that month, nor the following months of *June* and *July*, but had the orifice of the wounds, made with a ſmall Auger, in a manner quite grown up, and would ſcarce admit a Pigeons feather. Wherefore the 30th of *July* I cut out a ſquare piece of about two inches of the bark of a large and well-grown Sycamore, about my hight in the body of it: This wound began to run the next morning about 9 a clock, ſo as to drop; and that was all, and dryed up by 11 in the morning. The like cut I made in a young Sycamore the 8th of *Auguſt*; which in like manner bled the next morning, but ſtopp'd before 9 a clock. It did ſo for 2 or 3 days, but then totally drying. Afterwards removing to *York* the firſt of *November* I here pierced, and otherwiſe wounded two Sycamores; and having obſerv'd them my ſelf at times, when, according to my former Obſervations made in *Nottingham-ſhire*, I might well expect to have found them bleeding; yet they *never* ſtirr'd, that we could obſerve, to this day. Since

Mr. Wray hath aſſured me, that thoſe of *Warwick-ſhire* bled the 16th of *November* laſt paſt copiouſly; and ſince the *Walnut-tree* alſo. And ſo much for matter of fact.

To what cauſe we may truly refer this Anomalous Bleeding, is not eaſie to ſay. For my part, *I* am not apt to think, that there is ſuch a ſudden and extemporary Aſcent of Sap, at ſuch time as theſe Trees are moſt diſpos'd to bleed; but rather, that the Sap, in all parts of the Tree, is ſome ways notably *alter'd* in its temper and conſiſtence: And this Bleeding by ſtreſs of weather may in theſe Trees probably be look'd upon as a violence done to their natures from an unkind Climate; conſidering the *Walnut* and *Sycamore* as ſtrangers, and not natives of England. 'Tis indeed true, there are many ſorts of *Engliſh* Plants, which will bleed in Winter; but note alſo, that ſuch Plants never refuſe to do ſo at any time of the year, no more than a Man, who may bleed a vein when he pleaſeth. But let the Hypotheſis be what it will, *I* am perſwaded, we ſhall have but dark and imperfect notions of the motion of the Juyces in Vegetables, until their true Texture be better diſcover'd. To conclude this ſubject, I now put theſe two *Quaries*; 1. Whether the Juyce of Trees, whil'ſt alive and vegete, can properly be ſaid, at any time of the year, to deſcend, or to be wanting in any part, or not to be therein in a much like quantity? 2. What condition the Soil is of, where ſuch Trees are planted, that ſhall either bleed or refuſe to do ſo; whether Sandy, as that of *Nottingham*; or a wet Clay, as that of the two Trees, I have obſerv'd here at *York*?

An Extract of another Letter written by the ſame Gentleman, Mr. Wray, *to the Publiſher, of* Febr. 8th. $16\frac{70}{71}$. *Containing ſome Experiments about the Bleeding of the* Sycamore, *and other Trees; as alſo, a conſiderable Note of* Pliny *about the* Mulbery-Tree.

Concerning the *Bleeding* of the *Sycamore*, let me acquaint you with the following Experiment. The firſt inſtant it froze, the Wind at *North*; the Froſt and Wind continued (ſome little Snow and rain falling) the 2d, 3d, 4th, 5th, 6th, until the 7th in the morning, when the Wind came about to the South-Eaſt, and the weather broke up a pace. The Sycamores bled not all this while, but the 7th about Noon all Trees of that kind bled very freely, both at the Twigs and Body, and I ſtruck above a dozen.

At this ſame Critical ſeaſon I was willing to repeat the Experiment upon other Trees; and to this end I forthwith ſtruck the *Hawthorn*, *Hazel*, *Wild-Roſe*, *Gooſe berry-buſh*, *Apple-tree*, *Cherry-tree*, *Blather-nut*, *Apricock*, *Cherry-Lawrel*, *Vine*, *Walnut*; yet none bled but the laſt-named, and that faintly in compariſon of the *Sycamore*. This is conſonant to our former Experiments: And if it did happen (as I ſaid in my former Letter,) that theſe Sycamores bled not all this Winter afore at the wounds made the firſt of *November*, I do now think, that if new wounds had been ſtill made at every break of Froſt, ſome ſignes, at leaſt of our *York-ſhire* bleeding, might have been diſcover'd before now. But *I* affirm no more, than *I* have ſeen and tried.

In all the Monuments of the Antients, collected by the great induſtry of *Pliny*, *I* find but few inſtances of this nature. Amongſt thoſe few, there is one that is regiſtred with two or three remarkable circumſtances to our purpoſe. He tells us, that the Phyſitians of old, when they had a mind to draw the Juyce of the Mulberry-tree, were wont to ſtrike it skin-deep only, and that about two hours after Sun-riſe. This Experiment is twice mentioned by him, and in both places as a ſtrange *phænomenon*. We might make our Comment upon the places, but for this time are content only to tranſcribe the Texts. *Lib*. 16. *c*. 38. *Mirum; hic (cortex) in Moro, Medicis ſuccum quærentibus, ferè horâ diei ſecundâ, lapide incuſſus manat, altius fractus ſiccus videtur.* Lib. 23. c. 7. *Mora in Ægypto & Cypro ſui generis, ut diximus, largo ſucco abundant, ſummo cortice deſquamato, altiore plagâ ſiccantur; mirabili naturâ.*

Some Obſervations concerning the Variety of the Running of Sap in Trees, compared with a Weather-glaſs; made in April, 1670. *Together with ſome ways of ordering* Birch-water: *By Dr.* Ez. Tonge.

I Am this day very much confirmed in my apprehenſion, that Trees and other Plants, if we could contrive them, as I have

(but ſlenderly) projected in my *Sap-wiſer* to that purpoſe, would far better indicate the Alteration of Weather, as to heat, cold, moiſture, drought, than any Weather-glaſſes, I have yet experimented. For my Weather-glaſs continuing at one and the ſame ſtation, in a manner all this day (*April* 13.) my Trees have altered their temper ſo much, that 24 of them, that ran tolerably this fore-noon, yield not a pint of Sap this afternoon; and though one of them ran moſt part of the day, the reſt ceaſed about one or two of the clock in a fair clear Sunſhiny ſeaſon, retarded (ſo far as I could obſerve) only with a Weſtern wind; though that be reputed mild and cheriſhing.

Theſe Trees ran above two quarts in the morning. The Weather-glaſs continues the ſame, *viz.* about 11 inches water, theſe two days. *Thurſday* the 14th, it was 9½ only. *Friday* the 15th, my Weather-glaſs at noon was advanced from 9 to 10½, yet the quantity of Birch-water this day exceeded my former from theſe Trees; for I had above 2½ quarts before noon.

But for cold, I find, that the Air, when any whiſling blaſt of cold wind ſtirs, ſtays my Birches. I want a Wind-fane.

I would deſire by the by, that people would try with Mints and other hot, balſamick or aromatick herbs or roots, and eſpecially with *Roſemary*, put into their Bottles filled with Birch-water from the tree, to preſerve it, and to brew Ale with it. I had very fine and warming drink from a few ſprigs of Roſemary ſteep'd in Spirit of Wine; *I* purpoſe to try *Elecampane*, and roots of the like kinde.

Saturday, the 16th, theſe 24 Birches began to run preſently after Sun-riſe, and ran about 3 quarts, and ceaſed about two a clock after noon, having till then continued to run. *Sunday*, the 17th, it rained, ſo that we could make no Obſervations what Sap theſe Trees might ſpend; neither did Rain and all amount to much above a Gallon and a half. *Munday* the 18th, they ran until Noon. *Tueſd.* and *Wedneſ.* the 19th, and 20th, wherein was expected greater ſtore of Sap, after the Rain, the Trees ſpent not a drop. *Quere*, Whether it be from their buſie protruding of their leaves upon the rain? (of which yet there was then no appearance;) or the over-cooling and moiſtening of the Roots by plenteous Rain? *Saturday*, the 23th, my Weather-glaſs ſtood at 7½, it being a Rainy and boiſterous morning, the Rain not allaying the Wind. At 9 a clock of that fore-noon, my

Birch water worked in the Barrel *per ſe :* Which ſeems to verifie Mr. *Souton*'s relation from his Brother, a *Swediſh* Merchant, importing, that Birch-water in *Sweden* worketh alone; (perhaps collected in great quantity.) Only *I* put a very few Cloves into my Sap. Boiled to a third or leſs, it keeps well, eſpecially when boiled with the buds or ſprigs of the ſame Tree, as I have been informed.

April 16, 17, 18, in the year 1670. Birch-ſap mixed with Rain water at the Tree, fermented, with *Roſemary* ſprigs ſteeped in Spirit of Wine: which warmed the ſtomack as ſtrong Wine, and pleaſed the palate; though the taſte in the mouth was ſomewhat wateriſh.

A Letter written by the ſame Dr. Tonge, *to the Publiſher; about the Retarding the Aſcent of Sap, together with ſome other Queries relating to that Subject.*

SIR, laſt night Sir *R. Moray* did me the favour to acquaint me in diſcourſe with ſome particulars about the Gathering of Sap in Fruit-trees, and the Retarding the Aſcent thereof; which he had received from an eminent Planter in *Glouceſterſhire:* Concerning which, *I* thought it fit to communicate ſome Reflexions of mine; which you may diſpoſe of, as you think good.

It was propounded to me by way of *Quere*; How to gather every drop of Sap that ſhould riſe in any Fruit-tree? This, I ſaid, I thought not feaſible, by what I had experimented hitherto. My grounds were theſe; *Firſt*, in thoſe Trees, whoſe Sap ſeems to be of a Gummy nature when condenſed, as Plums, Cherries *&c.* I knew no Experiment, by which any drop of Sap could be collected. And I ſuſpect, ſome other Fruit-trees to be of that nature, whoſe Sap I could not draw out at any ſeaſon, of hot or cold weather, though they have not been obſerved to yield any Gum. Perhaps there may alſo be ſome Fruit- and other Trees, whoſe Saps are viſcous, though not Gummy; and theſe, I doubt, will not yield any Sap to be gather'd in any common or known way.

Secondly, it ſeem'd to me not feaſible, to gather all the Sap of thoſe Trees, whoſe Juyce is fluid and plentiful, and condenſeth into a gelly, becauſe it ſeems at moſt ſeaſons of the Year to aſcend imperceptibly; and that not only in the outward, but innermoſt parts and pores of the Tree; not only betwixt Bark and Wood, but betwixt every coat of the Wood, and even through the moſt ſolid parts of each Coat; as *Mr. Willoughby*'s Obſervations have diſcover'd, * unleſs I miſtake. The Experiment of the ſaid *Gloceſter ſhire* Planter, by which he hoped to gather all the Riſing Sap of Fruit-trees, was made, by binding the Trees round about very cloſely and ſtrongly with cords, ſo as to intercept what riſeth 'twixt Bark and Body; he being of opinion, that no conſiderable quantity riſeth in any other part. To which I oppoſe, beſides what was ſaid juſt now, that ſome Trees will live though they be disbarked in ſome place quite round; eſpecially if this be done in ſome ſeaſon, when the blaſting Winds ſtir not; which *I* have elſewhere diſcourſed of in my Letters to Sir *R. M.*

* See *Numb.* 48. *p.* 964.

Mean time, though this Planter ſeem to me to miſtake in the Riſing of Sap, yet he maketh it up by diſcovering to us, that ſuch Tying of Trees retards their Bloſſoming and Bearing; and ſo may in ſome years (as this preſent, in which the open weather haſtening bloſſoms, is like to deſtroy the fruit) prevent a ſcarcity of forward fruit, uſually nipped by the late Froſts.

Upon this diſcourſe *I* ſhall take leave to ſuggeſt theſe following Inquiries:

1. Whether two Trees, running, when both are free and untied, equal quantities of Sap at like orifices of equal breadth and depth, will run unequally, when ſtrongly tied; and if ſo, what will be the difference?

2. Whether the ſaid Trees will run unequal quantities at equal orifices made in *Roots*?

3. Whether the delay of Sap, ſtaying Fruit and Bloſſoms, as is ſuppos'd, by tying, will cure the *Phyllo-mania*, as Croſs-hacking?

4. Whether a Tree kept wholly from bearing this year (its uſual bearing year) will bear the next, and ſo to better advantage, when fruit is ſcarce?

5. Whether by this way, Trees may be brought to bear at other ſeaſons, than yet hath been practiſed?

6. Whether tying of Trees, made before Mid ſummer, cauſeth the Bark to ſwell *under* the Ligature, and after Mid-ſummer, *above* it? and whether equally, or by what different proportion?

7. Whether it will direct Sap to inoculated Buds, if the contrary ſide only be ſtopp'd by ſtrong binding?

8. Whether in paring the Bark quite round, or in part, covering the bare place with Lome, the ſame or like effects will follow?

9. Whether, in caſe the Bark above the Ligature ſwell moſt, it be to be attributed to the Sap deſcending, or to the permeableneſs of all parts of Plants by their Sap (as reſembling Bloud and other Humors in the Body,) which more readily deſcends than aſcends to heal the wounded part, or to ſupply intercepted nouriſhment?

Some further Inquiries, made by the ſame Dr. Tonge, *concerning the Running of* Sap *in Trees; the keeping of ſuch Sap, and brewing with it; a way of colouring of Leaves, Fruit,* &c. *As alſo about multiplying Crab-ſtocks, and propagating Trees by Layers,* &c.

1. WHether any Tree, that ran not at Noon in a clear and equally tempered day, ran the ſame day at night, or in any cooler part of the ſame day?

2. Whether a Tree, which gave over running the former day before night, ran the very next day all day and all night, at any trial?

3. Whether Trees beginning to run one day (ſuppoſe one hour) do at any time or ſeaſon of their running, the weather ſtill favouring them in their ſeaſon, encreaſe the time of their running, and ſo proceed gradually and conſtantly to their longeſt term; and whether they go on to run all night at laſt?

4. Whether Trees may then, and only then, be ſaid to be in their beſt ſeaſon of running; when they will run in the night or till the Sun-ſet? And when that ſeaſon is? and in what Trees? And whether then, and at that, or what ſeaſon, it be beſt to gather Sap for uſe?

5. Whether Trees are not ſometimes ſo full of Sap, that a greater quantity may by a large orifice, or many orifices, be drawn from them, than did riſe in them the ſame day? If ſo, then that caſe muſt be diſtinguiſhed from another caſe at an other time, wherein Sap riſes as well as runs all day, or all day and night, though ſlowly: And conſequently in all Experiments, the riſing and running of Sap muſt carefully be diſtinguiſhed, and it muſt be noted, when Sap runs of a ſtock of that liquor

former

formerly riſen, and when it runs only as it riſes?

6. If Sap do reſtagnate in any Trees at ſome ſeaſons, more riſing and remaining in them, than they digeſt? When that is? In what Trees? And how long it laſts? And how to be obſerved and found? Whether Sap ſo reſtagnating, be better digeſted, and fitter for uſe, being fermented, and inſolated, as it were, by moroſe expoſure to the Sun, or be thicker and clammier, and more near a gelly and unfitter for uſe?

7. What conſtant expoſure to the Sun in Bottles, corked or open, of Glaſs or Stone, operates in Sap? [*I* kept ſome in a large retort of 2 or 3 gallons, expoſed night and day (without any other ſtop than the obliquation of the Retorts neck, and a little paper to keep out Inſects,) many months, and it contracted a Coat on it's top, and the taſte pleaſing my palate; *I* adventured to brew with it at Cider-ſeaſon, and made a great quantity of good cordial drink with 8 Buſhels of chopt Apples, brewing them like Malt with hot water, and putting my Juyces and Saps into my water-Cider at the latter end of their boiling: *I* filled a Stand with it, which contained half the quantity of the largeſt Rheniſh-wine Veſſel, *viz.* about 40 gallons, as *I* remember. *I* had not half Sap in this liquor (the greateſt part of my Brewing being made with water) yet *I* got five buſhels and more of warming Cordial and pleaſant drink for every buſhel of my Apples: if it had been all Sap, it would have been much more cordial and ſtrong: There was in it a conſiderable quantity of juyce of Borrage-roots and herbs (at that ſeaſon uſually thrown out of Gardens,) which Borrage-liquor works and purges it ſelf when tunned, and turns into an excellent clear brown colour; and it may be tried, whether it may be brought to be a potable, pleaſant and wholſom drink alone, or with eaſie brewing with Ale, Cider or other liquors, apt to ſower, if it prove ſo (as *I* ſubmit to Inquirers,) that Borrage-liquor reſiſts Acidity in drink, (as the herb in flower and in ſubſtance is ſuppoſed to do,) and ſwims above water, Cider, or, when it's mixt with them, in gentle boiling doth preſerve them. I drank my drink the Eaſter following: So my Sap gathered at Spring, brewed about Michaelmaſs, continued good till Eaſter and after it.]

8. Whether a Glaſs, fitted to both ends of a Root, ſo divided, that there remain a diſtance of half an inch from that part

left adhering to the Tree, and that growing in the Earth, (which Glaſs I call my Sap-wiſer;) will be and continue always full of Sap, or only whileſt the Tree runs, or how long? And when? *Quære*, whether this Glaſs muſt be *cemented* on to both ends of the Root, before the Root runs; or whether it be better to put it on gently, and not too firm and cloſe, ſo as to exclude the Air?

9. Whether Saffron infuſed in Sap, or other tinging moiſtning Bodies, put into ſuch a Sap-wiſer, will tinge the whole Tree, wood, leaves, fruit, *&c.* or any of them? Or by the like infuſion in bored arms of any Trees have the ſame effect?

10. Whether by a Sap-wiſer the motion of Sap in Apples, Peares, and ſuch like other Trees, whoſe Sap is too ſubtil or too ſlow in motion to be otherwiſe diſcerned, may be obſerved, and be tinged?

11. If any Pear, or Apple, or Quince, may be made bloud-red by grafting on a Mulberry-ſtock? And whether being after removed to another, ſuppoſe a Quince-ſtock, it will retain its colour, and all Grafts taken from it alſo?

12. Whether Sap may by a Sapwiſer be transfuſed out of one Tree into another; and if ſo, what it will work?

13. Whether grafting, chamfering, indenting tong-wiſe, or inoculation well cloſed and waxed, will ſucceed in the Root, and whether in that part of a Root, which is cut off from the Body, and remains in the Earth? Whether grafting, inoculating, *&c.* in root and ſtock, be beſt, when the Sap is running, or before, or after running? Some affirm, that the dividing of Crab-ſtock Roots, from the ſtem left in the ground, is the beſt way of multiplying Crab-ſtocks, or a commendable one at leaſt?

14. Whether Crab- and Apple-kernels ſown in indifferent or barren ground, and weeded ſome years (after that the hopefulleſt ſpare Roots of the largeſt of thoſe are removed with the ſtocks for uſe,) the other Roots of leſſer ſize ſeparated from the ſtem being left in the ground, after 3 or 4 years growth or more (then come to be of half an inch diameter,) each Root thus carefully left in the ground with the top not bruiſed, but cut ſmooth, even, ſlope, and waxed, raiſed to the day only, may grow into a new Plant, or be inoculated, packt and grafted? and how ſoon?

15. Whether the Nature of Saps aſcending, or the Cauſe of of it, be after this manner; *viz.* That in the moiſt night, the Roots being ſpungy and ſoft in the extreme parts, draw in moiſture and ferment it; to which the Sun by his warmth gives farther fermentation in the Roots, and a pulſion upwards into the firmer parts of the Roots, and thence into the Body and Branches, and there digeſteth it? And whether by the ſame manner, the Body and Branches warmed, and exhauſted in the day by the Suns heat, digeſting and expending into leaves, *&c.* according to the ſeaſon, draw Sap out of the lower part to the extremities, ſo that when Digeſtion, or *Suction* (if there be any ſuch) exceeds *Pulſion*, Sap runs not. & *vice verſa*?

16. If Spungy and ſoft wood imitates Roots in their manner of ſhooting freſh Roots, and in the growth, after the way above mentioned?

17. Whether more ſolid wood, as Bays, *&c.* in moiſt and ſeaſonable weather laid, and fitted, or, as it were grafted in Willow-roots or ſticks, will ſhoot Roots in Layers, and grow as Mulberries do? [I have heard that a chip of ſoft wood, laid to the end of a *Bay*-ſlip, promotes its rooting: And that *Mulberry* ſlips are eaſily propagated, ſet in the latter end of *January*, or beginning of *February*, in a moiſt ſeaſon, not in dry *March*. Such ſlips root beſt, if they be Suckers, and taken off with part of the old bark; or if they be laſt years ſhoots, cut off from Arms, taken with ſome older bark from the place where they ſhot out. I have ſet many formerly, which all throve. I affect to propagate them for Pear, and other ſtocks, namely Quinces, Medlars, Plums, to turn their pulp and juyce red, by taking grafts from ſuch Trees, as have been grafted on Mulberries. *Quære*, if bloud-red Pears and red Redſtrakes were thus raiſed at firſt, or may be propagated, and to what advantage?]

18. *Quære*, if Quince-ſtocks conduce to make firm the pulp of Apples, and alter the form of them from what the Graſt naturally had before?

An Accompt of two Books.

I. *MISCELLANEA Curioſa MEDICO-PHYSICA Academiæ Naturæ Curioſorum.* Lipſiæ 1670. *in* 4°.

THis is a work very lately begun in *Germany* by a Company of ingenious Philoſophers, call'd *Academia*

Naturæ Curioſorum (an Academy of Curious Inquirers into Nature,) which ſome years ago have eſtabliſh'd themſelves in that Country, with a deſigne chiefly to improve *Phyſick* and *Natural Philoſophy*. For which purpoſe, they have, (as I find in their *Salve Academicum*, printed at *Leipſick*, *An*. 1662.) undertaken each of them, to conſider and write upon determinate ſubjects, thereby to penetrate into the nature and qualities of *Particular* Bodies (*Generals* having too long already buſied Mens Brains and Hands;) as of the *Vine*, *Tobacco*, *Aloe*, *Scurvy graſs*, *Wormwood*, *Scorzonera*, *St. Johns Worth*; *Iron*, *Braſs*; the *Unicorn*, the *Stagg*, *Crabbs*; the *Bloud-ſtone*, *Eagle-ſtone*; *Muſc*, *Civet*, *Amber*, &c. Beſides which, they have attempted, (after the way, taken up in *France*, *Italy*, and *England*,) to write and publiſh *Ephemerides*, or a *Diurnal*, or *Tranſactions* of a Philoſophical Nature, intending therein to preſent the Curious yearly with ſuch *Medical*, *Anatomical*, *Botanical*, *Pathological*, *Chirurgical*, *Therapeutical*, and *Chymical* Obſervations, as they ſhall by their correſpondence either with the Phyſicians and Philoſophers of their own Body and Nation, or with thoſe of other Societies and Countries, procure and digeſt. And of this they give a *Specimen* in the Book, of which an Accompt is now to be given, out of that *Exemplar*, which was ſent from that Generous Body by the hands of the Learn'd Dr. *Sacks*, (a Member of the ſame) to the Publiſher. In it are contained 160 Obſervations, and 19 Tables of *Figures*; being the Sum of what they have collected for the firſt Year, which is 1670.

Of them we ſhall Engliſh, for a taſt of the Curious here, what followeth; obſerving the promiſcuous way of recital, which is in the Book it ſelf. Among others then (till more Copies of the Book come over,) we take notice of:

1. A Relation of *Snakes* kept tame in an Houſe, going into their boxes every night, and ſeen to caſt their ſkin, and (one of them) to lay 13. Eggs in the ſpace of an hour and a half, facilitated by him that kept them; who alſo diſſected one of them, and communicated the remarkable things in that Operation.

2. An Hiſtory to evince, that part of the *Chyle* is by the *Ductus Thoracicus* conveyed into the *Subclavials*, and ſo into the Ciſtern of the Breaſts, whence by certain Pipes it is carried into the *Glanduls* or Kernels, there to be elaborated, either for the

aliment of the breaſts themſelves, or the food of *Fœtus's*.

3. An Obſervation of a *Polygonum Cocciferum*, or a *Grain-bearing Knot-graſs* in *Poland*, whoſe Grains being expoſed to the Sun, are turn'd into live Worms, which when dried and ſo moiſtned, and pulverized, tinge with a *Crimſon* colour.

4 A Deſcription of an Anti-pleuritick Medicine, (much uſed and commended by *Petrus a Caſtro*, formerly chief Phyſitian to the Duke of *Mantua*) made of the Rindes of the longer ſort of *Italian Pumpions*, boyled in very old Oyl of Olives, and ſtrained through a ſleeve.

5. A Deſcription of a Remedy for an Atrophy of the Eye, lighted upon by chance, when the Eye of an *Uro-gallus* (or *Cock of the Wood*) being diſſected, the Aqueous humour, by a deep inciſion thereof, did ſpirt into the Eye of the Operator, who thereupon found the pains of his Eye, which was much dried, and did ſmart by over-much lucubrations, aſſwaged, and his ſight improved; and afterwards upon occaſion did adviſe to inſtil the like juyce of ſuch and other Cocks into the Eyes of a young man, who by his debauches had purchaſed a kind of Conſumption in his Eyes.

6. A Narration of a Serpent petrified in the ſtomack of a Stag; kept in the Repoſitory of the Count of *Hanow*, approaching to the colour of a Bezoar-ſtone, and weighing about 23 ounces. As alſo of the Brains of divers Oxen turn'd into ſtones.

7. An Accompt of an Horny ſubſtance grown out, near the two laſt ſhort Ribbs, to a conſiderable length, reſembling the Horn of a young Deer. Whence occaſion is taken to relate many odd Obſervations of Horns grown in all ſorts of Animals, Birds, Fiſhes, Four-footed Beaſts, and even in ſome Men.

8. A way of making a Perſon born Deaf to hear, by ſpeaking to him over the *Coronal ſuture*, well ſhaved and waſhed, after certain Purgations made of the Brain, ſpecified in the Book.

9. Of an Egg naturally bred in an Egg; of Stones naturally found included in Stones; and Animals in Animals, and Fruit in Fruit.

10. Of a Child born Hydropical; and of a *Fœtus* febricitant whilſt in the womb, as was judged by certain red and livid marks appearing on it when it came forth.

11. Of

11. Of a Child, one year old, ſo diſeaſed with the *Hydrocephalus*, that when open'd, there were taken out of his Head 36 ounces of clear, but ſaltiſh, water; whereupon the Brain was by the attentive beholders ſeen ſo flatted and extended, as to ſtick cloſe to the convex ſides of the whole skull, like ſome thick membrane: There being alſo found a conſiderable quantity of the like liquor within the Cheſt of this Infant.

12. Of Worms let out by Venæ-ſection, and Urine.

13. Of the *Periodical* Head-ach, recurring daily at a certain hour in the morning, and laſting until noon; and ſeizing only the external part of the face over the right Eye; remedied by letting of bloud, and compreſſing the part.

14. An Obſervation of the plenteous growth of *Vincetoxicum* or Swallow-wort in the Counties of *Stiria* and *Carinthia*, moſt inhabitants of which are troubled with the *Scrofulæ* or Kings Evil, curable with the root of that Plant, having in it very Volatil, piercing, and diſcuſſing Spirits; upon which account, the Author eſteems it alſo very powerful againſt Dropſies.

15. Of a *Fœtus* tinged yellow by Saffron in the *Uterus*, related by *Amatus Luſitanus*, and verified here by an Experiment made upon a Bitch big with Puppy's; though the Chyle in the Lacteous Veſſels was whitiſh.

16. Of ſeveral Stones come away together with the Bloud of a man of 72 years of Age, being blouded in the Arm.

17. Of a ſort of *Crafiſhes*, which taſte bitter when boyled; taken in a ſmall River called *Obra*, in the Confines of *Sileſia* and *Polonia*, there growing on the Bank of that River great ſtore of wild *Calamus Aromaticus*, on the Roots of which theſe *Crafiſhes* have been obſerved to feed greedily.

18. Of a Flame broken out of ſeveral ſtomacks, and burning like Spirit of Wine, both in dead Animals, and living Men.

19. A way of Dwarfing men, by anointing their Back-bones, in their very infancy, with the greaſe of Moles, Batts, and Dormice; together with an Intimation of the Art, uſed at *Bononia* to dwarf their Dogs, by often waſhing (from the firſt day they are pupp'd) their feet and back-bone; thereby drying and hardning thoſe parts, and ſo hindring their extenſion.

20. An Abſceſſe in the *Abdomen* well cured at *Vienna* by an inciſion made about 4 inches under the ribbs, upon which followed

lowd a plentiful eruption of purulent matter, which continued to run for many weeks.

21. Of many odd Examples, not of women only, but men alſo, greedy to eat very ſtrange things; eſpecially of a Boy, that, without any viſible prejudice to his health, did eat Sand, Chalk, Brick, Snuffs of Candles, Dirt, *&c.* though his Mother had not been obſerved to eat any ſuch thing, when ſhe bred him. To whom may be joyned the ſeveral devourers of Glaſs, Stones, and Nails, innoxiouſly voided again by ſiege.

22. Of making *Chylous* Wine, without any diſeaſe in the Kidneys or Bladder, in an Atrophy of the whole Body, there wanting no paſſages, by which the Chyle may come into the Emulgent and Urinary Veſſels.

23. Of an *American* Aloe, planted in *Sileſia*, and remaining ſteril for 31 years, but after that time ſhooting out very many branches, and flowers: its chief ſtem 18 foot high, bearing 21 branches, whereof ſome had above 200 flowers, which together with the main ſtem withered away. And of ſuch an other, in *Miſnia*, which in a few days grew up to the height of 12 inches, growing every natural day a whole palm, and ſhooting out 32 branches, in an admirably regular order diſtant from one another, and in their extremities each producing ſtore of flowers variouſly coloured.

24. Of two rare Symptoms about the Sight. *One* of a perſon, that tuning the ſtrings of a Muſical inſtrument, one of them ſnapping aſunder, hit his right eye with a ſmart ſtroke; after which, ſome proper cooling Ophthalmicks having been applied, the Patient after Midnight awaking, ſaw all things, in the dark, as clear as if it had been full day, being able to diſcern the ſmalleſt lines of pictures, and to read printed papers: Whereas when a Candle was brought to him, or in the Sunſhine, he could ſee nothing at all. The other is, of a man infected with the *Lues Venerea*, who, after that the other ſymptoms were abated, found his ſight ſo diſtemper'd, that all Objects appear'd to him *double*; which yet at length ceaſed.

25. An Obſervation of a *Muſcus Terreſtris* (Ground-Moſs) which being gather'd in *Auguſt* and *September*, and reduced to powder, fulminateth, when held or blown into a flame; the ſame is ſaid by *Olearius*, in his *Moſcovy and Perſian Voyage*, to be uſed by thoſe people in their Artificial Fires; who adds,

that Powder of *Roſin* doth the like.

26. Of a Noble-man in *Sileſia*, who was ſo ſtrong, that with his hands alone he could break a Horſe-ſhoe, and a Ryxdollar; and hold, at one and the ſame time, three Men, two under his Arms, and one by his Teeth faſtned in his cloaths: who once alſo, when he hunted the Wild Boar one of thoſe Beaſts of a good bigneſs ruſhing upon him, took him with one hand by the hair under the Snout, and with the other hand ran him through with his Sword. This ſame perſon could at one dinner drink off a whole *German Ohm* full of Wine.

27. Of a *Bezoar ſtone* encompaſſing a Dart, found in the *Emperours* Repoſitory, and eſteem'd to have been taken out of a Bezoar breeding Goat, which being ſhot in ſome fleſhy part with an arrow, the Salin-Tartareous particles, ſwimming in the Bloud of that Animal, and wont to breed Bezoardick ſtones in it, were by the continual motion of the Bloud carried to that part, where they gathered and ſtuck about the Arrow.

28. Of Eeles being Viviparous, one of theſe *Academicians* affirming, that himſelf had in *Holland* taken ſeveral of them out of an Eels womb, wrapt up in ſeveral membrans.

29. Of an Hermaphrodite-Stockfiſh, having both Melt and Rowe; as alſo of two Crocodils, of both Sexes.

30. Of a ſtrange Antipathy to Muſick in a man, that as ſoon as he heard an Harp touch'd, could not hold his water, *&c.*

31. Of Light inbred in the Inſect, call'd *Scolopender*, ſhining in the dark, and ſparkling when compreſſed.

32. Several Obſervations concerning the *Milk diet* againſt the Gout, together with a debate upon that ſubject; and the manner of uſing the ſaid Diet.

33. Of *Mercury* crowded into the Crural Vein of a Dog, to the quantity of half an Ounce, without any hurt appearing in the Animal.

34. Of a Jaſpar-ſtone, worm eaten.

We leave here unmention'd many other curious Obſervations, related in this Work, partly for want of room, partly becauſe of the unfitneſs of many of them to be expoſed to the view of all ſorts of Readers.

II. *PHYSICA, in Decem TRACTATUS DISTRIBUTA*, Auth. *Honorato Fabri*, S. J. Lugduni Galliarum, 1669, in 4°.

Of this vaſt work, the Author publiſh'd *An.*1666. at *Paris*; two Treatiſes; the firſt, *De Plantis & Generatione Animalium*; the latter, *De Homine*; by a kind of Retrograde method, oppoſing the Order of *Publiſhing* to that of *Compoſing*: For, whereas in the *Compoſition*, he proceeded from the ſimpler things to the Complexed; in the *Publication* and Communication, he thought fit to produce the *Whole* of all Nature, that elaborate piece, *Man*; in whom, beſides the Senſitive and Vegetable Faculties, and the powers of Mixts, and the Elements, common to all Bodies, there ſhineth out a ſupereminent Principle, the Rational Soul.

In the Book, which beareth the above-mentioned Title, the Author giveth in the *Preface* an Accompt of the Method, uſed by him in this whole Work, and of his Performance in this very Volume.

Concerning his Method, he ſaith, That he hath comprehended the whole Phyſicks, or all Natural Philoſophy in *Ten* Treatiſes, in a *Geometrical* method, (which how he performeth, we leave to ſtrict Mathematicians to judge;) beginning from thoſe things that firſt incur into our ſences, *viz*. In the *Four* firſt Treatiſes, he handles of The ſenſible *States* of Bodies, as the Corporeal *Quantum*; Of Bodies Tenſe and Compreſs'd, *Rare & Denſe*, Heavy and Light, where of the *Motion* of Bodies, Natural, Violent, and Mixt; Opack & Diaphanous, Wet and Dry, Hard and Soft; Tough and Dry; Flexible and Stiff; Fiſſil and Brittle; Friable and Ductil; Liquid and Liquable; Inflammable; Exhalable; Spirable; Of Heat, and Cold; of Light, Colours, Sounds, Odors and Taſts; and of the Reſiſtence of Bodies.

In the *Fifth*, he treateth of the Principles of Bodies Natural, of their Generation and Corruption, and the Four Elements.

In the *Sixth* and *Seventh*, of Mixtion and mixt Bodies, Imperfect and Perfect.

In the *Eighth* of Celeſtial Bodies.

In the *Ninth*, and *Tenth*, of Plants, Animals, and *Man*.

As to his Performance in this Volume, he therein diſpatcheth the *Four* firſt Treatiſes. In the whole, he profeſſeth to have followed the Principles of *Ariſtotle*, except where clear Experiment and Demonſtration neceſſitate to recede from him; obſerving withal, how much that Philoſopher hath been perverted by *Averroës*, and the reſt of that *Arabian* Crew.

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